North Carolina
Department of Environment and Natural Resources

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Director

April 15, 2003

MEMORANDUM

To: Tim Jewett

From: Bobby Lutfy BL

RE: MRR of High Point, LLC
Construction and Demolition Debris Landfill
High Point, North Carolina

The Revised Site Application *and* the Phase 1 Construction Plan Application for the MRR of High Point C&D Landfill facility have been reviewed. With the recent revisions these reports now meet the hydrogeologic portions of the Solid Waste Management Rules.

CC: Jim Coffey
Jim Barber
Hugh Jernigan

1646 Mail Service Center, Raleigh, North Carolina 27699-1646
Phone: 919-733-4996 \ FAX: 919-715-3605 \ Internet: www.enr.state.nc.us

MEMO

JOYCE ENGINEERING, INC.

Henderson Building
2301 W. Meadowview Road, Ste. 203
Greensboro, North Carolina
Phone – 336.323.0092
Fax – 336.323.0093
dmoore@joyceengineering.com

To: Bobby Lutfy, & Tim Jewett **From:** Tom Herlihy

Fax: **Pages:**

Phone: **Date:** 4-1-03

Re: MRR of High Point, LLC Permit Application **CC:**

☐ Urgent ☐For Your Use ☐ Please Comment ☐Please Reply ☐ Please Recycle

• Comments:

Bobby & Tim

Attached are the revised Site Plan Application Drawings and an updated Table 1 for this Application. In addition the entire narrative portion of the Construction Plan Application is attached with a revised Table 1 for this Application. The only change in the narrative for the Construction Plan Application reflects that JEI supplied DENR the actual drawings from the City of High Point's approved Erosion & Sedimentation Control Plan (ie how drawings are referenced in the text). We felt it easier (and simpler) to simply replace the entire narrative portion of the Construction Plan Application than submit separate pages.

Volume I, Section I Site Application

New Drawings SA-0 through SA-8 (three copies – two (2) to Bobby, and one (1) to Tim). These drawings reflect the revised base grades (3/31/03) to replace the set submitted with the application of 1/17/03. Please remove all drawings from the 1/17/03 binder and replace with these drawings

New Table 1 to reflect the Airspace and projected capacity of the facility. Replace the Table 1 in the 1/17/03 package with this Table.

Volume II, Construction Plan Application

The entire narrative portion of the Construction Plan Application with a new Table of Contents (three copies – two (2) to Tim, and one (1) to Bobby. Additionally a revised Table 1 to reflect the Airspace and projected capacity of the first five (5) years of the facility. This table replaces the Table 1 in the 1/24/03 package

Please let me know if you need anything else.

Tom

Fac/Perm/Co ID# 41-16 | Date 5/23/13 | Doc ID# | DIN 7/3/13

Prepared for:

MRR of High Point, LLC
421 Raleigh View Road
Raleigh, North Carolina 27610

JEI PROJECT NO. 600.00, TASK 03

VOLUME TWO
CONSTRUCTION PLAN APPLICATION

MRR OF HIGH POINT, LLC

CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL

GUILFORD COUNTY, NORTH CAROLINA

JUNE 2002

REVISED
JANUARY 2003
MARCH 2003
APRIL 2003

APPROVED
DIVISION OF WASTE MANAGEMENT
SOLID WASTE SECTION
DATE 5/14/2003 BY TAD
PERMIT # 41-16
RALEIGH CENTRAL FILE COPY

APR 2003 Received Solid Waste Section

Prepared by:

JOYCE ENGINEERING, INC.

Joyce Engineering, Inc.
Henderson Building, Suite 203
2301 West Meadowview Road
Greensboro, North Carolina 27407
(336) 323-0092

NORTH CAROLINA PROFESSIONAL SEAL 023854 ENGINEER MICKLE D. ELLIOTT

Prepared for:

MRR of High Point, LLC
421 Raleigh View Road
Raleigh, North Carolina 27610

JEI PROJECT NO. 600.00, TASK 03

VOLUME TWO
CONSTRUCTION PLAN APPLICATION

MRR OF HIGH POINT, LLC

CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL

HIGH POINT, NORTH CAROLINA

JUNE 2002

REVISED JANUARY 2003

Prepared by:

JOYCE
ENGINEERING, INC.

2301 West Meadowview Road, Suite 203
Greensboro, North Carolina 27407
(336) 323-0092

STATEMENT OF COMPLIANCE WITH CONSTRUCTION PLAN APPLICATION REQUIREMENTS

It is our opinion that the information and design presented in this Construction Plan Application for the proposed MRR of High Point, LLC, Construction and Demolition Debris Landfill meet the requirements of Rule .504 of the North Carolina Solid Waste Management Rules, 15A NCAC 13B.

Respectfully Submitted
JOYCE ENGINEERING, INC.

M. D. Elliott
11/24/03

Mickle Elliott, P.E.
Senior Technical Consultant

VOLUME TWO
TABLE OF CONTENTS

STATEMENT OF COMPLIANCE WITH ENGINEERING PLAN REQUIREMENTS

TABLE OF CONTENTS (Continued)

TABLES

FIGURE

DRAWINGS

TABLE OF CONTENTS (Continued)

APPENDICES

1.0 GENERAL

In accordance with the North Carolina Solid Waste Management Rules, 15A NCAC 13B, Section .0500, MRR of High Point, LLC (MRR) is submitting this Construction Plan Application. The application has been prepared to demonstrate compliance with the applicable regulatory requirements so that a permit to construct may be issued for the first five-year phase of the proposed MRR of High Point Construction and Demolition Debris (C&D) Landfill.

The facility is located along the eastern border of the City of High Point, along the west side of Riverdale Drive, SR 1145, beginning approximately 800 feet south of the intersection of Riverdale Drive and E. Kivett Drive in southern Guilford County, North Carolina (See Drawing CP-1). The property is owned and will be operated by MRR. The proposed C&D landfill facility property will consist of approximately 154 acres, of which 49.2 acres will be used for C&D waste disposal.

Joyce Engineering, Inc. (JEI) has prepared this Construction Plan Application in accordance with the requirements of 15A NCAC 13B .0504(2). This report contains information pertinent to the construction and operation of the first five-year phase of the proposed C&D landfill. Section 2.0 describes the comprehensive development of the C&D landfill as required by Subsection .0504 of the Rules, and includes drawings, figures and tables. The Operations Plan, Section 3.0, describes the operational requirements for the C&D landfill as required by Subsection .0505 of the Rules. The Closure Plan and Post Closure Plan, Sections 4.0 and 5.0, describe the closure and post-closure requirements for the C&D landfill as required by Subsection .0510 of the Rules.

Information related to the landfill siting requirements is included in the Site Application (Volume One) that is being submitted in conjunction with this Construction Plan Application. References to Volume One are made as needed to clarify or support the design of the C&D landfill.

1.1 Existing Conditions

This section describes the site location, its physical layout, and current land usage. Geologic and hydrogeologic characteristics are discussed within Volume One, Section II.

The proposed site is located in the southwestern portion of Guilford County, North Carolina, and, since its annexation by the City, forms part of the western border of the City of High Point. A site location map is provided as Figure 1. The site is immediately adjacent to the potential expansion area of the Kersey Valley Landfill, and is just west of the Riverdale Drive Landfill, the High Point Material Recovery Facility, and the city's wastewater treatment plant.

Access to the site will be from SR1145 (Riverdale Drive), approximately 0.25 miles south of the intersection of Riverdale Drive and E. Kivett Drive. A Duke Power right-of-way runs across the southern portion of the property in an area not expected to be affected by the proposed development. The site is bounded on the east by Riverdale Drive (SR 1145) and by privately owned properties; on the south by privately owned properties, properties owned by the City of High Point, and Cashatt Road (SR 1155); on the west by privately owned properties and properties owned by the City of High Point; and on the north by privately owned properties.

Appendix 1 contains a boundary survey plat of the property proposed for development. The existing conditions and surrounding topography are shown on the Drawing CP-2. The drawing also includes the locations of on-site benchmarks, soil borings and piezometers.

The site is characterized by gently sloping hillsides ranging in elevation from 710 to 810 feet above mean sea-level (MSL). Portions of the site have been farmed in the past, and portions have been logged and cleared. The remainder of the site is undeveloped. Two residences and associated outbuildings, as well as several abandoned farm structures used by the previous property owners are currently present on the site. One residence, located along the western border of the site, will remain and may be used as the landfill office; all other structures on the site will be demolished or removed.

2.0 CONSTRUCTION PLAN

The purpose of this section is to satisfy the requirements of .0504 (2)(h), which requires a written report that addresses the proposed development, the projected capacity and life, and general operating and waste management procedures of the first five-year phase, referred to hereinafter as "Phase 1", of the proposed C&D landfill.

2.1 Proposed Development

The MRR High Point Construction and Demolition Debris Landfill will be owned and operated by MRR of High Point, LLC. The overall site development is expected to include a C&D disposal area, a main entrance road, access roads, scale and scale-house, recycling processing area, material storage area, and erosion and sediment control features.

Phase 1 will be developed within the westernmost portion of the disposal area. Phase 1 is approximately 12.5 acres in size and will consist of 5 cells. The development of subsequent Phases (2-7) will progress predominantly from west to east adjacent to Phase 1. The limits of Phase 1 are shown on Drawing CP-3.

2.2 Base Grades

The base (subgrade) of the proposed C&D landfill will consist of the existing underlying soils. Base grades have been designed to be at least four feet above the estimated seasonal high groundwater table and bedrock elevations. Underlying soils are predominately silty sands/sandy silts, and sandy clay/clayey sands. If unsuitable soils are identified during preparation of the subgrade, they will be removed and replaced with suitable compacted material. A land surveyor licensed in North Carolina will verify that the dimensions and elevations of the base grade are in accordance with the approved plans prior to submittal of an application for a Permit to Operate.

Proposed base grades and the estimated seasonal high groundwater and bedrock elevations are shown on Drawing CP-4. See Volume One, Section II for a detailed discussion of the hydrogeologic evaluation of this area. Proposed base grade elevations within Phase 1 are generally governed by the estimated seasonal high groundwater elevations along the southern and western portions of Phase 1; the base grades are generally governed by bedrock elevations as

the cell extends to the higher elevations along the northern and eastern portions of the disposal area.

2.3 Final Cover System

Proposed final grades for Phase 1 are shown on Drawing CP-5. Final grades have been designed with post-settlement surface slopes of at least five percent at the top of the landfill, and a maximum of 3 horizontal to 1 vertical (3H:1V) on the side slopes. Cross-sectional details of the proposed final grades are provided on Drawing CP-8.

The cap system will consist of the following: a 12-inch intermediate cover and leveling course, an 18-inch compacted soil layer, and a 6-inch vegetative layer. The cap components are discussed in detail in Section 4.0 of this report.

2.4 C&D Waste Stream

Service Area: The MRR of High Point Construction and Demolition Debris Landfill will serve Guilford County and portions of Forsyth, Davidson and Randolph Counties, which have a current estimated population of 1,000,000.

Disposal Rates and Waste Stream: MRR of High Point, LLC, projects that the facility will initially accept approximately 700 tons of C&D waste material per day. Approximately 55% of the incoming material will be recycled; the remainder will be disposed at the facility.

Types of Waste Specified for Disposal: The facility will only accept construction and demolition (C&D) debris, and land-clearing and inert debris (LCID). All other waste is prohibited from disposal. Construction and demolition debris is waste or debris resulting solely from construction, remodeling, repair, or demolition operations on pavement, buildings, or other structures. Land clearing debris is waste that is generated solely through land clearing activities.

2.5 Landfill Capacity

The projected waste capacity of Phase 1 is approximately 790,000 cubic yards or 457,500 tons. This volume does not include weekly cover soils or final cap material. Based on the projected waste stream, Phase 1 has a life expectancy of 5.1 years (see Table 1). The capacity was calculated using airspace volumes between the base and final grades obtained from Softdesk Civil\Survey software integrated with the construction drawings produced using AutoCAD, Release 2000.

The in-place ratio of waste to soil used to calculate the operating life and operating soil requirements was assumed to be 9 to 1. This is based on the assumption that a 6-inch lift of cover soil will be placed on the working face once per week. An in-place compaction density of 1,350 pounds per cubic yard was used in determining the projected life of the disposal area.

Approximately 160,500 cubic yards (cy) of soil will need to be excavated to achieve the Phase 1 base grade elevations, as depicted on Drawing CP-4. Excavated material that is unsuitable for use as structural fill or for construction of the cap will be segregated for use as weekly cover.

Approximately 69,800 cy of material will be needed as fill to construct the visual berms, material handling area, and access roads. Approximately 72,000 cy of material will be needed for weekly cover. The cap will require approximately 44,000 cy of soil material. The remainder of the soil, approximately 41,000 cy, will be available for future development of additional phases or other on-site needs. The on-site soil resources, usage, and balance for Phase 1 are provided in Table 2.

The data and assumptions used in projecting the capacity are consistent with the disposal rates discussed in the preceding section, and are representative of the operational requirements and conditions anticipated for the new facility.

2.6 Waste Management Procedures

During operating hours, traffic will be routed from the entrance gate and scalehouse to a road leading to the reclamation pad and disposal area. Phase 1 may be developed as 5 individual cells, which can be constructed as needed. Appropriate CQA documentation, including as-built base grades, will be submitted to the Solid Waste Section for review prior to initiating landfill disposal operations. An approved Permit to Operate will be obtained prior to the disposal of waste.

Recoverable materials will be separated from the C&D waste stream at the proposed reclamation pad. The recovered materials will be recycled as appropriate. These procedures are described in more detail in the discussion of material recovery in Section 3.1.5 of this report. Section 3.2 contains information on the proposed waste-screening program that precludes the acceptance of unauthorized waste and addresses other operational issues.

3.0 OPERATION PLAN

This operation plan describes how the design and construction plans will be implemented during the life of the facility. The text, drawings, and appendices illustrate general operating conditions, cell progression, waste placement, daily operations, and special waste management.

3.1 General Operating Conditions

3.1.1 Facility Contact

The owner of the site is:

MRR of High Point, LLC.

The facility contact for the site is:

Norbert Hector
421 Raleigh View Road
Raleigh, North Carolina 27610

Phone Number: (919) 835-3655
Fax Number: (919) 835-3622

3.1.2 Hours of Operation

The landfill will operate between 7:00 A.M. and 7:00 P.M., Monday thru Friday, and between 7:30 A.M. and 1:00 P.M. on Saturdays. The facility will be closed on the following major holidays: New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day. If the facility will be closed during other holidays, third party haulers will be notified in advance.

3.1.3 Site Access and Safety

Access to the facility will be controlled through a single entrance road. A metal gate will prevent access after operating hours. A sign containing the information required in Rule .0505 (9) (i.e., acceptable wastes, hours, permit number, etc.) will be posted at the facility entrance. Waste collection vehicles will be weighed in (and out if tare weights are not available for that vehicle) at the scale house. Signs will be posted directing traffic to separate areas of the facility. Traffic will move from the scales to the landfill via a gravel haul road. The layout of haul roads may change as needed during the course of landfill development so that there is convenient access to active disposal areas. Access roads will be maintained to remain passable during anticipated weather conditions. An attendant will remain on duty at the scale house during operating hours.

3.1.4 Waste Acceptance

Only construction/demolition waste and land clearing and inert debris are proposed for disposal at the C&D landfill. Construction and demolition debris is defined in NC General Statutes as waste or debris resulting solely from construction, remodeling, repair, or the demolition of pavement, buildings, or other structures. Land clearing and inert debris includes waste such as stumps, trees, limbs, leaves, brush, grass, brick, block and untreated wood.

In accordance with Division policy, other waste types may be proposed for disposal that are similar to waste typically found in land clearing-inert debris and construction/demolition waste streams. Examples might be roofing shingle waste from the shingle manufacturer, waste building materials from a mobile home/modular home manufacturer, or wooden pallets. If other wastes are proposed for disposal at this facility, requests for approval will be submitted in accordance with Division requirements.

On or before August 1 of each year, MRR of High Point, LLC, will report to the Solid Waste Section the amount of waste received in tons at this facility and disposed in the waste disposal areas. The reporting period shall be for the previous year beginning July 1 and ending on June 30. Data will be transmitted on forms prescribed by the Section. The report will include the following:

- The amount of waste received and disposed in tons, compiled on a monthly basis by county or transfer station of origin, and by specific waste type if diverted to a specific unit within the permitted facility; and

- The completed report shall be forwarded to the Regional Waste Management Specialist for the facility. A copy of the completed report shall be forwarded to the County Manager of each county from which waste was received.

3.1.5 Material Recovery

Certain materials in the C&D waste stream will be recovered and transported off site for recycling. C&D waste with potential recyclable materials will be dumped on the reclamation pad for sorting. Recyclable material will be manually and/or mechanically separated from C&D waste that will be disposed in the landfill. Examples of recyclable materials that may be pulled from the waste stream include, but are not limited to: lumber, wood waste, pallets, drywall, cardboard, plastics, ferrous metals, non-ferrous metals, concrete, bricks, soils, asphalt, and de minimus amounts of other non-hazardous materials that are generated at construction and demolition projects. The type of recyclable material that will be sorted from the waste stream at any given time is market dependent.

3.1.6 Prohibited Waste

In accordance with Rule .0505(11)(b), no hazardous or liquid waste may be accepted for disposal. The C&D landfill will not accept:

- municipal solid waste (MSW), including household, commercial and industrial waste;
- hazardous waste as defined within 15A NCAC 13A, including hazardous waste from conditionally exempt small quantity generators;
- polychlorinated biphenyl (PCB) wastes as defined in 40 CFR 761;
- barrels and drums (except fiber drums containing asbestos), unless they are empty and sufficiently perforated;
- friable asbestos;
- yard trash defined as solid waste consisting solely of vegetative matter resulting from landscaping maintenance;
- other wastes specifically banned from landfill disposal by rule or statute, such as lead acid batteries, whole tires, used oil, or aluminum cans.

MRR of High Point will notify the NC Division of Waste Management within 24 hours of attempted disposal of hazardous waste or other waste that the landfill is not permitted to receive. Municipal solid waste (MSW) that is received will be placed in containers and transported to a permitted Subtitle D MSW landfill. The waste-screening program is described in Section 3.2.

3.1.7 Litter Control

Windblown litter is not anticipated to be a significant problem at the C&D landfill due to the heavy, bulky nature of this waste type. Prompt compaction of the waste at the working face will be conducted to minimize litter. Additionally, at the end of each day of operation, landfill personnel shall collect all windblown material resulting from the operation of the facility and return it to the working area. Temporary fences may be constructed if needed to contain windblown material during operations.

3.1.8 Air Quality

Open burning of waste, including yard waste and brush, is prohibited at the landfill.

3.1.9 Dust, Odor, Fire and Vector Control

Dusty road surfaces will be sprayed with water as needed during windy, dry weather.

Significant odors and disease vectors are not anticipated at the C&D landfill. The waste will be covered weekly.

Site operators will observe incoming waste loads for evidence of fire such as flames, smoke, or the odor of burning material. If evidence of fire exists, the landfill operator will evaluate the situation to determine whether the fire can be extinguished using fire extinguishers and/or other equipment at the site, or if off-site equipment is needed. Waste that is burning will be removed or segregated from other waste in the disposal area, if possible. If necessary, the local fire department will be called to render assistance in extinguishing the fire. Pinecroft Sedgefield Fire Station No. 22 services the fire district surrounding the site. Water in sedimentation ponds and nearby creeks can be used by firefighters to assist in extinguishing fires. Fires that occur at the landfill will be reported verbally to the NC Division of Waste Management within 24 hours, and in writing within 15 days.

Fire extinguishers will be carried on each piece of landfill equipment on site, and will be used for small, localized fires. Equipment operators will be trained in the use of these extinguishers. A small stockpile of soil will be maintained near the working face to be used for extinguishing small surface fires that are too large to control with fire extinguishers.

3.1.10 Scavenging/Salvaging

The unauthorized removal of waste, or scavenging, is prohibited at the landfill. Landfill personnel may remove recyclable salvageable materials and process them through MRR of High Point's recycling program.

3.2 Random Waste Screening Program

3.2.1 Authority

To prevent the acceptance of prohibited wastes, the following random waste screening program is proposed in accordance with the North Carolina's Solid Waste Management Regulations, Rule .1626(1)(f). The program is primarily used to detect hazardous waste that is mixed with MSW. However, the same methodology can be used to keep hazardous wastes and prohibited MSW from being disposed at the C&D landfill. Key elements of this rule are as follows:

- No hazardous or liquid wastes as defined in 15A NCAC 13A, municipal solid waste, or materials offering an undue hazard to landfill personnel or landfill operations shall be accepted at the C&D landfill except as specifically authorized by the facility permit or by the Division. The owner or operator shall implement an inspection program to detect and prevent disposal of non-permitted wastes, hazardous and liquid wastes, and polychlorinated biphenyls (PCB). This program shall include, at a minimum:

- Random inspections of incoming loads, unless the owner or operator takes other steps to prohibit incoming loads containing municipal solid waste, regulated hazardous or liquid wastes, or PCB wastes;

- Records of any inspections;

- Training of facility personnel to recognize municipal solid waste, regulated hazardous or liquid wastes, or PCB wastes; and other non acceptable wastes;

- Development of a contingency/action plan to properly manage non-permitted or hazardous and/or liquid wastes that are identified.

3.2.2 Random Selection

Vehicles will be randomly selected for inspection on a regular basis. At least one vehicle per week, but not less than one percent by weight of the waste stream (based on the previous week's total) will be randomly selected at the working face by the personnel conducting the inspection. A random truck number and time will be selected (i.e., the tenth load after 10:00 a.m.) on the day of inspections.

3.2.3 Record Keeping

The Waste Inspection Form and, if applicable, the Refuse / Identified Waste Inspection Form (included in Appendix 2) will be completed at each inspection. Reports and resulting correspondence will be maintained at the landfill office for the life of the landfill and during the post-closure period.

3.2.4 Training

Inspections will be supervised by the operator or by support personnel trained to identify and manage C&D waste, municipal solid waste, and hazardous and liquid waste.

3.2.5 Location

Inspections will be conducted at or near the working face of the landfill.

3.2.6 Contingency/Action Plan

The following action plan details the procedures to follow for conducting random waste inspections.

1) Dump single load in prepared area and hold truck and driver until inspection is completed.

2) Spread waste with a loader, as appropriate. Loads that include large closed containers will be handled carefully to avoid possible rupturing of the containers. Have appropriate safety equipment present. Minimum safety equipment will include:

   - Rubber gloves;
   - Rubber boots;
   - Safety glasses; and
   - Long handled hoe.

3) Examine waste for excluded waste and/or safety hazards:

   - Municipal solid waste (MSW);
   - Containers labeled hazardous;
   - Excessive or unusual moisture;
   - Biomedical (red bag) waste;
   - Powders, dusts, smoke, vapors, or chemical odors;
   - Sludges, pastes, slurries, or bright colors (such as dyes); and
   - Unauthorized out-of-County waste.

4) Take Action: One or more as appropriate:

   a) Incorporate acceptable waste into working face;

   b) Remove MSW to a permitted Subtitle D MSW landfill or transfer facility for disposal;

c) Hold suspect waste for identification by on-site personnel and confirmation by others, if necessary, such as a contract laboratory or regulator;

d) Interview driver and hauler to identify the waste source;

e) Remove hazardous or liquid waste (In Priority Order):

- Hold rejected hazardous or liquid waste for generator;
- Arrange for hazardous or liquid waste collection by licensed collector.

f) Use the USEPA Hazardous Waste Inspection Decision Tree. (See Appendix 2)

5) Document Actions:

a) Record Inspection;

b) Retain Reports;

c) Report hazardous liquid, or PCB wastes to Solid Waste Section - DENR.

3.3 Waste Compaction And Equipment

3.3.1 Filling Operation Cell Progression

The method of filling will be in accordance with the filling sequence shown on Drawing CP-6. Operations within Phase 1 will start at the southeastern portion of the disposal area, and progress west and northward. The projected annual phasing plan throughout the life of Phase 1 is also shown on Drawing CP- 6. Cross-sections through the disposal area are shown on Drawing CP-7.

The size of the working face will be maintained as small as possible to minimize contact with stormwater. The width of the working face will vary, depending on the rate of waste acceptance on a given day and weather conditions.

The waste will be dumped in the active cell as closely as possible to the working face, and then pushed to the desired area. The length of the daily working face will be maintained at approximately 100 feet to provide space for several trucks to dump at the same time. The debris will be spread and compacted by a self-propelled landfill compactor. At least 4 to 6 passes in orthogonal directions will be made by the compactor prior to the placement of another layer of debris.

Inactive portions of the cells that have not received waste will be separated from the active area by the use of temporary diversion berms to segregate uncontaminated runoff from contaminated runoff. As filling progresses, the diversion berms will be relocated to allow for continued filling within the cell. As subsequent cells are opened in the planned sequence, uncontaminated stormwater will be diverted around the active portions of cells for collection and removal.

Inactive areas of the various cells that have received waste will be covered with an intermediate soil layer. Uncontaminated runoff from these areas will be routed through channels or pumped into stormwater channels that will convey the flow to an on-site sediment basin.

3.3.2 Landfill Equipment

MRR will purchase typical landfill equipment for use in conducting waste disposal operations. Equipment such as excavators, loaders and compactors will be required.

3.3.3 Cover Material

At the end of each week's operation, the compacted waste in the current lift will be covered with cover soil. At least 2 to 3 passes of heavy equipment will be made over the area to compact the soil. Whenever a subsequent lift of waste will not be placed for at least 12 months, additional soil shall be placed over the cover material already in place to provide a minimum 12 inches of intermediate cover. A vegetative ground cover to minimize erosion shall be provided within 90 calendar days following completion of a development phase.

3.4. Environmental Monitoring Program

3.4.1 Water Quality Monitoring

The Water Quality Monitoring program for groundwater and surface water is described in Volume One, Section II.

3.4.2 Landfill Gas

Landfill gas is not expected to be a significant by-product from the disposal of C&D waste.

3.5 Erosion and Sediment Control Requirements

The operator shall not cause a discharge of pollutants into waters of the United States, including wetlands, that violates requirements of the Clean Water Act, including, but not limited to, the National Pollutant Discharge Elimination System (NPDES) requirements, pursuant to Section 402, or cause the discharge of a non-point source of pollution to waters of the United States, including wetlands, that violates requirement of an area-wide or Statewide water quality management plan that has been approved under Section 208 or 319 of the Clean Water Act, as amended.

Embankment slopes will be inspected regularly for erosion, and mowed at least once each year. These slopes will be maintained by reseeding, the application of fertilizers, and other means necessary to promote a healthy stand of vegetation. Recommended seeding specifications are included in Appendix 3. All vegetative and structural erosion and sediment control devices will be maintained according to the North Carolina Erosion and Sediment Control Planning and Design Manual. Channels and basins will be kept free of excessive debris and sediment.

The text for the Erosion and Sediment Control Plan (E&S Plan) for Phase 1, and supporting calculations for proposed stormwater conveyance channels and sediment basins are located in Appendix 4 of this report. The final E&S Plan with attachments (supporting documentation) for the Phase 1 development will be submitted to the City of High Point Central Engineering Department, P.O. Box 230, High Point, NC 27262.

3.6 Record Keeping Requirements

The following records will be maintained in the Operating Record at the landfill office:

- The Permit to Construct, Permit to Operate and pertinent correspondence and other permits;
- Operation Plan;
- Inspection records, waste determination records, and waste screening programs;
- Amounts by weight of construction/demolition debris received at the facility, including the source of generation;
- Water Quality Monitoring Plan and any demonstration, certification, finding, monitoring, testing, or analytical data required by the approved water quality monitoring program at the site.

3.7 Training

Personnel responsible for conducting monitoring activities, site inspections and maintenance will be competent individuals trained in the skills needed for their job. Personnel will receive training as new programs become available.

A qualified firm will conduct groundwater and surface water monitoring, and a certified environmental laboratory will conduct laboratory analysis.

4.0 CLOSURE PLAN

4.1 General

The site will be closed incrementally as landfilling progresses. The landfill is designed so that closure can occur in stages when final contours are reached in a given area. Once an area has reached the elevations where it can logically be closed, closure activities will be carried out according to the criteria below. Ultimately, a final cover system will be constructed over the entire footprint (Phases 1-7) to minimize the infiltration of stormwater, and provide for the establishment of a vegetative cover.

4.2 Area To Receive Final Cover

The proposed Phase 1 footprint with projected final grades on the southern and western slopes is shown on Drawing CP- 5. The slope depicted on the northern and eastern sides are intermediate grades prior to the construction of future phases, and would represent final grades prior to

capping in the event that the site is not further developed. Assuming that the southern and western slopes are capped independently of the remainder of Phase 1, the cap would be approximately 7.5 acres in size.

4.3 Cap Design

Final contours have been designed with post-settlement surface slopes of at least five percent on top of the cell. Final side slope grades will be limited to a maximum of 3H:1V. A cross-sectional detail of the proposed closure cap is provided on Drawing CP-8. The following components are proposed as shown on the detail:

a. Intermediate Cover and Leveling Course - Local soil will be placed on top of the final layer of weekly cover soil to provide at least 12 inches of intermediate cover and a uniform base for construction of the cap.

b. Compacted Soil Layer and Vegetative Layer: A compacted soil layer of unspecified permeability, at least 18 inches thick, will be constructed on top of the intermediate cover. A layer of topsoil material or organically amended local soil at least 6 inches in thickness will be placed on top of the compacted layer. The 6-inch layer will constitute a vegetative layer for the establishment of a vegetative cover on top of the landfill cap. The vegetative layer will not be heavily compacted so that vegetative growth will be promoted.

c. Vegetative Cover: After placement of the vegetative layer, the area that has been closed will be seeded with a grass and/or wildflower mixture. Recommendations regarding soil amendments and seeding mixtures will be obtained and incorporated into the seeding specifications. Mulch and erosion matting will be used as needed to control erosion.

4.3.1 Drainage and Erosion

A combination of drainage ditches, diversion berms, slope drains and permanent vegetative cover will be used to control stormwater runoff and erosion. Sediment control features will be provided to minimize the transport of sediment off-site. Erosion and sediment control features will be designed in accordance with applicable criteria of City of High Point Central Engineering Department, and the North Carolina Erosion and Sediment Control Planning and Design Manual. See Drawings ES-3 through ES-7, which are copies of the E&S Plan approved by the City of High Point.

4.3.2 Closure Plan Schedule

The projected operating life of Phase 1 is approximately 5 years. However, the landfill is designed so that it can be closed incrementally as final contours are reached in various areas. Prior to beginning closure of any portion of the facility, MRR will notify the Division that a notice of intent to close the facility has been placed in the operating record.

An itemized list of closure milestones and a proposed schedule follow. Closure activities are proposed to begin within 30 days of final receipt of waste in the area to be closed. Construction

of the closure cap is to be completed within 180 days following the initiation of closure activities. The total length of the proposed closure period is 210 days following the final receipt of waste.

The approximate closure milestones that are shown below are proposed for use in tracking the progress of closure activities. A detailed schedule will be established prior to construction.

Proposed Closure Milestones and Schedule

Milestone	Proposed Schedule from the Date of Final Receipt of Waste
Testing of borrow sources	Within 6 months prior to closure
Grading of intermediate cover	Within 30 to 60 days
Placement of soil cap	30 to 150 days
Final inspection of cap by P.E.	150 to 180 days
Construction of stormwater controls	90 to 180 days
Seeding and mulching	150 to 180 days
Preparation of survey plat	180 to 210 days
Submittal of closure certification	180 to 210 days

4.3.3 Cap Construction

Once final grades are established, a detailed design for the closure cap and associated stormwater control structures will be provided. Plans and specifications will be prepared, as well as a construction quality assurance plan. Borrow soil for cap construction has not been specifically identified at this time. If there is an insufficient quantity of suitable soil on-site, then the owner will locate an off-site source of suitable soil, and haul the material to the landfill for use in cap construction.

4.3.4 Certification

Upon completion of closure, a licensed professional engineer acting on behalf of the owner will submit a Certification of Closure to the Division. This Certification will state that the site was closed in accordance with the Closure Plan and applicable solid waste regulations and laws.

5.0 POST-CLOSURE CARE

5.1 General

The C&D Landfill cap maintenance and environmental monitoring will be conducted for at least five years following closure of the landfill. The length of the period can be increased or decreased in accordance with Division directives.

5.2 Contact

MRR of High Point, LLC, will handle questions and/or problems that might occur during the post-closure care period.

CONTACT PERSON:	Mr. Norbert Hector
OWNER:	MRR of High Point, LLC
ADDRESS:	421 Raleigh View Road Raleigh, North Carolina 27610
PHONE NUMBER:	(919) 835-3655

5.3 Security

Access to the site will be controlled by the use of barriers (fencing) and gates at the facility entrance. These control devices will be maintained throughout the post-closure care period, and inspected as part of the monthly inspection program. Barriers and gates will be clearly marked with signs stating the name and nature of the facility and the person to contact in case of emergency or breach of security.

5.4 Post-Closure Maintenance

Post-closure maintenance and monitoring will be conducted at the C&D landfill for at least five years after final closure. Monitoring will include semi-annual sampling of groundwater and surface water, and monthly inspection of the final cover. Maintenance needs identified through the monitoring program will be initiated no later than 60 days after the discovery, and within 24 hours if a danger or eminent threat to human health or the environment is indicated. Minor cap maintenance may be deferred until there is a sufficient amount of work to justify the mobilization of equipment and personnel. Unusual or extreme maintenance needs due to calamities or vandalism might require the implementation of emergency contract service procedures established by MRR of High Point, LLC.

5.5 Inspection Plan

Routine inspections will be conducted throughout the post-closure care period. These inspections will be carried out semiannually unless problems are detected which indicate a need for more frequent visits. Potential impacts to the public and environment will be considered in determining the inspection frequency. Items to be included in the monthly inspection will be as follows:

- Access and security control
- Stormwater management
- Erosion and sediment control
- Gas management

- Groundwater and landfill gas monitoring systems
- Integrity of site benchmarks
- Vector control.

Post-closure maintenance and groundwater monitoring well maintenance inspection forms have been prepared for use during each inspection (see Appendix 5). The owner will keep completed copies of the inspection forms; copies will be forwarded to the Division for its records.

5.6 Post-Closure Land Use

The primary land use for the site after closure of the landfill will be open dormant green space.

5.7 Environmental Monitoring

Semiannual groundwater and surface water monitoring will continue to be conducted as outlined in the approved Water Quality Monitoring Plan for a period of time to be determined by the NC Division of Waste Management.

[End]

TABLES

Table 1

JOYCE ENGINEERING, INC.

Job:	MRR of High Point, LLC
Job Number:	600, Task 05
Calculated By:	TH Date: 1/22/2003
Checked By:	TH Date: 1/23/2003
Subject:	Capacity Calculations
Sheet:	1 of 2

Determine the total airspace available for waste in Phase 1.

Total airspace for waste, weekly cover soil and intermediate/final cover (V_t)		790,022 cy	volume from AutoCadd
Airspace consumed by the eventual final cover (V_{f1})	=	37,056 cy	(Vf=AreaFin x dfinalcap)
Airspace consumed by the intermediate cover (V_{f2})	=	7,163 cy	(Vf=AreaInt x dintcap)
Total Airspace consumed by the cover (V_{ft})	=	44,219 cy	($V_{f1} + V_{f2}$)
Airspace consumed by weekly cover (V_s)	=	75,297 cy	($V_s=V_t-V_f$ x %soil)
Total airspace available for waste (V_w)	=	***677,670 cy***	($V_w=V_t-V_f-V_s$)

Determine the estimated life of Phase 1.

Total waste volume (V_w)	=	677,670 cy	
Total waste mass volume (M_w)	=	457,427 tons	($M_w=V_w$ x D/2000)
Projected remaining life of the the disposal unit	=	***5.1 years***	

Landfill Parameters:

Wa	=	average daily waste acceptance rate	=	315 tons/day
		(based on a 5.5 day work week)	or	1732.5 tons/week
D	=	average inplace density of waste	=	1350 lbs/yd^3
%soil	=	waste to soil ratio (9:1)	=	10 %
AreaFin	=	area of final cover	=	333,501 sq-ft
dfinalcap	=	depth of cap (final and intermediate cover)	=	3 ft
AreaInt	=	area of intermediate cover	=	193,401 sq-ft
dintcap	=	depth of cap (intermediate cover)	=	1 ft
Total Area	=	Area of Phase 1	=	12.1 Acres

Table 2

JOYCE ENGINEERING, INC.

Job: MRR of High Point, LLC
Job Number: 600, Task 05
Calculated By: TH Date: 1/22/2003
Checked By: TH Date: 1/23/2003
Subject: Capacity Calculations
Sheet: 2 of 2

Determine the overall soil balance for Phase 1.

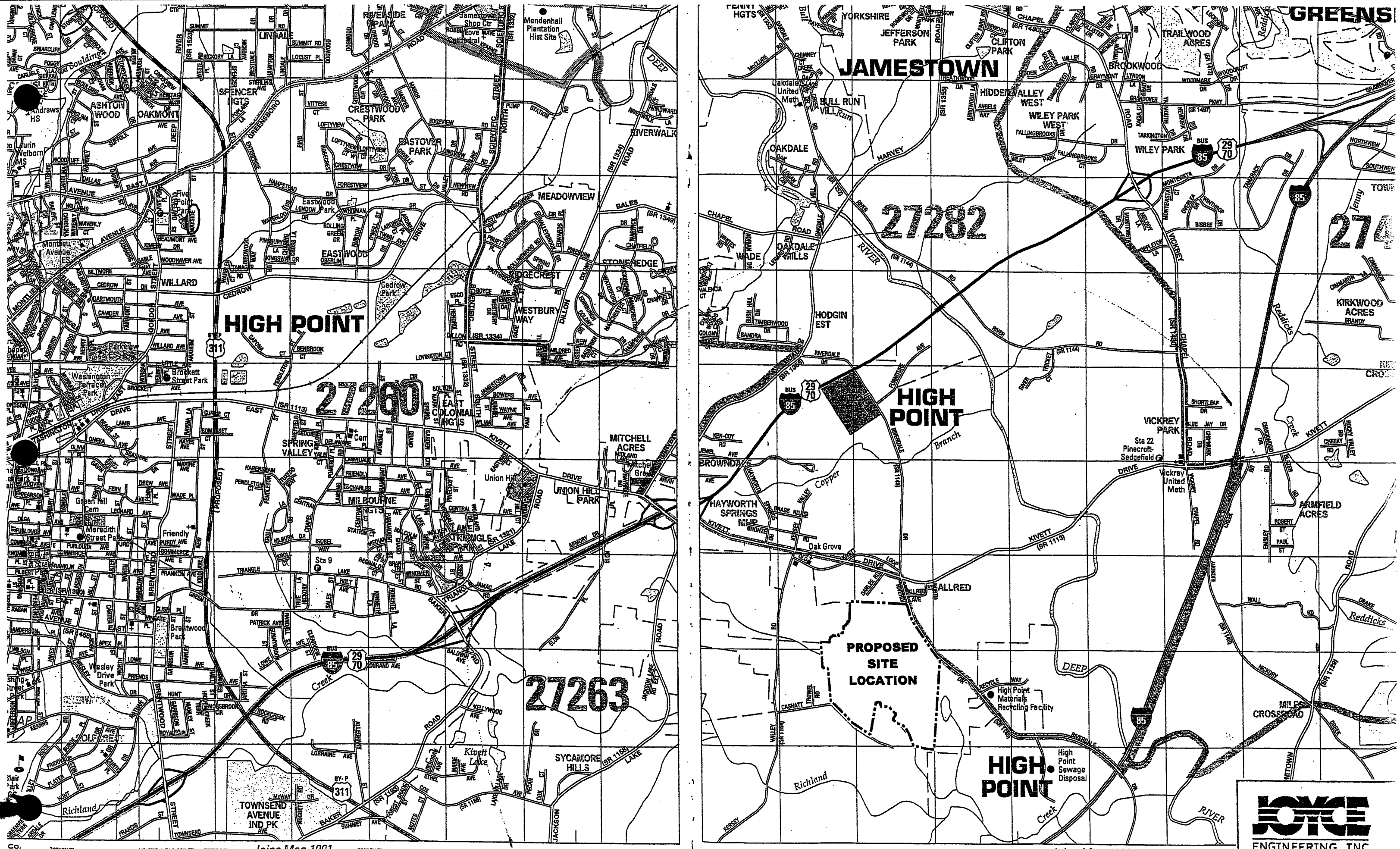
Total cut resulting from the construction of the Phase 1 (base grades, perimeter road, main access road and sed. basins)	=	224,215 cy	volume from AutoCadd
Total fill needed to develop Phase 1 (base grades, perimeter road, main access road and sed. basin)	=	53,829 cy	volume from AutoCadd
Soil needed for weekly cover	=	73,018 cy	
Soil needed for the final cover	=	44,219 cy	
Soil balance	=	53,149 cy	

Total soil available	=	224,215 cy
Total soil needed	=	171,066 cy
Total soil balance	=	**53,149 cy**

Landfill Parameters:

%soil	=	waste to soil ratio (9:1)	=	10 %
dcap	=	depth of cap (final and intermediate cover)	=	3 ft

FIGURE



JOYCE ENGINEERING, INC.

FIGURE 1

DRAWINGS

Prepared for:

MRR of High Point, LLC
421 Raleigh View Road
Raleigh, North Carolina 27610

JEI PROJECT NO. 600.00, TASK 03

VOLUME TWO
CONSTRUCTION PLAN APPLICATION
RECLAMATION FACILITY OPERATIONS PLAN

MRR OF HIGH POINT, LLC

CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL

HIGH POINT, NORTH CAROLINA

JUNE 2002

REVISED JANUARY 2003

Prepared by:

JOYCE
ENGINEERING, INC.

2301 West Meadowview Road, Suite 203
Greensboro, North Carolina 27407
(336) 323-0092

TABLE OF CONTENTS

TABLE OF CONTENTS, continued

ATTACHMENTS

INTRODUCTION:

This section of the Construction Permit Application is for the operation of MRR High Point, LLC, material recovery facility. The recovery facility proposes to accept non-hazardous construction and demolition debris for the purpose of screening, separating, redistributing, and marketing certain components of this select waste stream. The facility is located along the eastern border of the City of High Point, along the west side of Riverdale Drive, SR 1145, beginning approximately 800 feet south of the intersection of Riverdale Drive and E. Kivett Drive in southern Guilford County, North Carolina (See Drawing CP-1).

A) General Operations:

1) Conditions of Acceptance:

The waste accepted at the proposed site will be debris from building construction, remodeling, repair, and structural demolition. Prior to separation, the debris from each load will be screened visually by a trained foreman for potentially hazardous material. All haulers will be notified of acceptable and unacceptable material prior to dumping of materials.

Acceptable material includes wood, roofing, plastic, ferrous & nonferrous metals, drywall, concrete, cardboard, brick, asphalt, carpet, dirt and other miscellaneous construction and demolition materials. Unacceptable wastes include any regulated quantity of hazardous waste, any liquid waste, or other material banned from C&D landfill disposal by North Carolina rule or statute. By-pass materials are materials that the facility will accept, but cannot resell on the market. Examples include treated wood, asphalt, roofing material, visqueen and carpet. The by-pass material will be disposed of in the construction and demolition landfill proposed along with this application.

In order to comply with North Carolina's guidelines for treatment and processing facilities, each load entering and exiting the site will be weighed at the scalehouse. This will be done in order to help document the facility's capability to process and remove recyclable material from the waste stream. Records of weight, material, and use will be made by the scalehouse attendant. The operator of the facility will review these records monthly and submit them to the North Carolina Solid Waste Section for review on a yearly basis.

2) Waste Disposal Sites:

The primary disposal site that will receive wastes from MRR High Point, LLC will be the landfill sharing this permit. The Coble Sandrock Construction and Demolition Landfill located at 5833 Foster's Store Road; Liberty, NC; Permit Number 0105 will be used as an emergency back up.

3) Facility Operators:

Juan Carroll and Norbert Hector are the individuals responsible for site operations. Chris Roof serves as operations manager, and Doug Neul, the site supervisor, has had hazardous awareness and asbestos training.

4) Air Quality:

A water line and sprinkler system will be installed in order to control dust during dry periods. A water truck will also be used on an as needed. This equipment is expected to be on the site full time between the C&D landfill and reclamation facility.

5) Storage of Materials:

The following is a list of materials and the estimated storage volumes prior to removal. Pleae see Drawing CP- 13 for a layout of the storage areas on the 425' x 425' reclamation facility pad):

Material	Area/Quantities
Hazardous Material	As needed basis
C&D Residual / By-pass Material	75' x 150' x 20' / approx 8,330 yd^3
C&D Material (Unprocessed)	125' x 125' x 20' / approx 11,330 yd^3
Clean Wood	
– Unprocessed (Stockpiled)	75' x 75' x 20' / approx 4,166 yd^3
– Processed (shredded chips)	75' x 150' x 20' / approx 8,330 yd^3
Non-Ferrous Metals	
– Insulated wire	
– UBC (aluminum cans)	50' x 50' x 20' / approx 1,850 yd^3
– Misc. Aluminum	
– Copper	
Ferrous Metals	75' x 75' x 20' / approx 4,166 yd^3
Drywall*	50' x 50' x 20' / approx 1,850 yd^3
Concrete, Asphalt, and Brick	75' x 75' x 20' / approx 4,166 yd^3
OCC (cardboard)	20' x 50' x 15' / approx 1,500 yd^3
Fines (RSM – Recovered Screened Material)	75' x 150' x 20' / approx 8,330 yd^3
Recoverable Items (doors, lumber, etc...)	25' x 150' x 20' / approx 8,330 yd^3

*Due to market considerations there are no plans currently to recover drywall, but the capacity exists to include this material as conditions warrant.

- Commodities should be stored in designated areas only.

- Commodities recovered have a positive monetary value, and are not considered waste products.

- Recovered commodities are sold when market conditions (commodity price/volume) will maximize the economic return on the cost of reclamation. Therefore different commodities will remain stockpiled for longer than others while awaiting the appropriate market conditions.

6) Separation and Processing of Material:

Material will enter the site by first passing over the scales, where total weight, source of the load and material type will be noted. Material will be unloaded onto a concrete pad where it will be screened for unacceptable wastes (labeled truck tipping area on Drawing CP-13). Incoming trucks will be held until their loads can be screened, unless there is high traffic volume. The reclamation center will be responsible for unacceptable waste on-site. Materials placed on the processing pad will be processed within two days under all normal operating conditions.

Large quantities of non-recoverable material may be taken directly from the scale house to the landfill and not subjected to the screening and picking process.

An initial gross separation will occur in the tipping area where dimensional lumber and recoverable items (doors, competent brick/block, and pipe etc...) will be pulled and placed into a designated storage area (See Drawing CP 13). After this gross sort, material will be moved from the tipping area and loaded into a surge/feed hopper which distributes the waste across the conveyer belt leading to the screener. The conveyor moves the material to a heavy-duty screener where material that is less than two (2) inches in diameter is separated. This minus 2" material is hereafter referred to as "fines". Fines containing large quantities of dirt may be further screed and resold for use in soil applications. If appropriate markets are not available, excess fines (above the volumes shown on Drawing CP-13) will be placed in the landfill.

After screening, a conveyor moves the "overs" material to the picking stations where hand separation of recyclable materials from by-pass (waste) materials occurs. The picking line will be elevated over five (5) separate steel bins. It is anticipated that the configuration of the bins will be as follows: two (2) for clean wood, one (1) each for ferrous/non-ferrous metal, cardboard, and concrete/asphalt/brick. Materials such as treated wood (i.e. wood that has stains, varnishes, creosote, etc.), roofing, dirt, carpet and other miscellaneous materials that are not hand separated, refereed to as "by-pass", are deposited at the end of the line. By-pass material will be sent to the on-site landfill.

During high winds, snowfall events or other unusual circumstances that endanger the safety of personnel and/or clients, the clients will be notified that operations will be discontinued. When dust emissions are high due to dry weather, steps will be taken to reduce the amount of emissions by wetting access and ancillary roads. During wet conditions waste will not be tipped into accumulated precipitation for product quality reasons.

THIS PAGE CONTAINS CONFIDENTIAL & PROPRIETARY BUISNESS ARRANGEMENT INFORMATION – DO NOT COPY OR DISTRIBUTE PAGE 4 & 5

7) Final Disposition of Unacceptable Material:

Because of the possibility that hazardous material could be received at the site, the reclamation center will be considered a small quantity generator, as defined by the United States Environmental Protection Agency (EPA). Under these regulations, the site will be able to accumulate between 100 and 1000 kilograms per month for a 90-day period. The owners plan to contract the transport and disposal of this material to licensed and qualified transporters and permitted treatment, storage and disposal facilities.

8) Final Disposition of By-pass Material:

By-pass material will be shipped as needed or when over 8,333 cubic yards is accumulated, to the on-site construction and demolition debris landfill associated with this application. In the event of a major disturbance to our landfill Coble's Sandrock, as described in the Section (A) (3) will be used.

9) Final Disposition of Recyclables:

Material that is recovered from this process will be sold and hauled to various parties that MRR has developed business relationships with using the experience from our Raleigh, North Carolina facility. Depending on economic considerations and market fluctuations, we intend to market the following materials to the companies identified in Table 1.

Table 1. Markets for Recycled Materials

Material	Market/Company	Comment
Ferrous/Non-Ferrous Metals	Atlantic Scrap & Processing	
	D.H. Griffin Wrecking	
	Alcoa	
	Wise	
OCC-Cardboard	Paperstock Dealers	
	Piedmont Paperstock	
	Sunoco	
	Tidewater Fiber	
Wood Waste	Weyerhaeuser	
	Trigen – BioPower, Inc.	
	Green Power, LLC.	
Crushed (brick, block, concrete)	Used on site for haul roads etc…	

Material	Market/Company	Comment
Drywall	McGill Environmental	As market available
	Union Gypsum	
Plastic –Film &Rigid	KPS	As market available
Recoverable Materials – Brick, Block, Doors, R-Board, and etc…	On-site purchasers	
Fines	Used as cover blend	As market available
	Re-screed for soil applications	
	Used by composters	

B) Material Screening Plan:

1) Purpose:

The purpose of this plan is to comply with NCAC T15A.13B.0302(2). The key elements of the plan include:

1) Visual inspection of each load that enters the facility,
2) Records of all inspections,
3) Training of facility personnel to recognize regulated hazardous and unacceptable waste, including asbestos containing materials; and,
4) A contingency plan to properly manage any unacceptable wastes.

2) Procedure for Visual Inspections:

1) Initial visual inspections will begin with each truck unloading their shipment onto a concrete pad, and prior to being loaded onto the processing equipment. The truck and driver will be detained if unacceptable material is discovered during the unloading process.

2) The shipment will be spread with a Bobcat and/or hand tools as appropriate. Loads that include items such as large closed containers will be hand-raked to avoid possible rupturing of the containers. Minimum safety equipment will include:

- Leather or Rubber gloves,
- Safety boots,
- Safety glasses,
- Long handled hoe,
- Hardhats,
- Dust masks and,
- Fire extinguishers

3) The shipment will be examined for unacceptable and/or hazardous waste and safety hazards:

- Containers with hazardous placarding or markings,
- Any material containing asbestos,
- Household garbage,
- Any containers with liquids, oils, varnishes, stains, or paints,
- Sludges,
- Regulated biomedical (red bag) waste,
- Any material with "chemical odors," powders, smoke, dusts, or vapors
- Any drums or commercial sized containers,
- Materials with bright or unusual colors,
- Household hazardous wastes and,
- Any waste banned from landfill disposal by North Carolina statute or rule.

4) In the event that unacceptable wastes are found in a shipment, the appropriate actions are as follows:

- Hold suspect waste for identification by on-site personnel and, if necessary, confirmation by others such as a contract laboratory, hazardous waste management firm, or state and/or federal regulator,
- Interview driver and hauler to identify the source of suspect waste in the load,
- Hold rejected shipment for generator,
- Arrange for a hazardous or liquid waste collection by a licensed collector and,
- Properly clean the screening area to prevent contamination.

5) Document Actions:

- Record inspection,
- Retain reports and,
- Report hazardous or unacceptable shipments to the Solid Waste Section-DENR.
-

3) Record Keeping:

Report forms for record-keeping purposes are included in Appendix (IV). These forms will be completed when unacceptable materials are observed. All reports and resulting correspondence will be maintained at the Material Reclamation, LLC.

C) Management Plan for Unacceptable Materials:

In the event that unacceptable material is unloaded on the processing pad, the entire shipment will immediately be isolated. The waste will be held until it can be shipped to a hazardous waste disposal unit. During the interim, the waste will be properly secured against unauthorized removal, segregated from all other operations and protected against inclement weather conditions. In addition, proper storage will be dictated by RCRA 40 CFR 264 (Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities) and other applicable regulations. It will be the hauler's responsibility to pay for the disposal of unacceptable materials. It will be the responsibility of the facility owner to contract the proper transport and disposal of the unacceptable material by qualified personnel.

D) Management Plan for By-pass Material:

By-pass material includes treated wood, roofing materials, dirt, carpet, wet drywall and other miscellaneous material. The by-pass material will be taken to the on-site landfill

E) Management Plan for Recyclable/Reclaimable Material:

Reclaimable material will include clean wood, plastic, nonferrous metals, ferrous metals, drywall, cardboard, concrete, brick and asphalt. Clean wood products that have been deemed recyclable will be ground for shipment and then shipped as boiler fuel, furniture pressboard or mulch. Concrete and asphalt will be stored on-site and when quantities reach an appropriate level, a mobile crushing unit will be brought to the site for further processing. The crushed material will be stockpiled on site for use as road base material. Other reclaimable material will be shipped off-site as the quantities and market conditions reach an appropriate level.

F) Equipment Information:

1) Capability and Arrangement of Processing Equipment:

The system includes the following equipment or equivalent:

One 15 cubic yard feed hopper – Complete with variable speed hydraulic or electric motor. Hopper consists of an open feed hopper with heavy-duty 3-ply belt and spring loaded impact plate. The support frame and hopper sides will be engineered with heavy-duty materials designed for the C&D application.

One 56'x60" Incline Belt – Hydraulic or electric driven belt will carry material from the hopper to the screen. The feed section will consist of a heavy-duty impact plate to absorb impact of material from the hopper and high skirt boards with 35-degree troughing idlers to prevent spillage.

One 6x20 Step Deck Incline Screen with Punch Plate Screens – Screen box will be mounted in a support tower with walkways for access and maintenance. Approximate weight: 25,000 lbs.

One 4030 Conveyor.- Hydraulic/electric powered radial stacking conveyor to stockpile fines from screen.

One 60"x100', 5 bay Elevated Picking Belt – Complete with 20' of transfer belt from screen and 80' of picking belt. Includes roof and walkway with 10-drop chutes for sorting. Safety rails and emergency stop cables included.

Portable Grizzly Grinding Mill (or equivalent)- Vertical grinder process wood, rigid plastics, and other commodities to 4" minus.

The throughput capacity for the recycling equipment is 60 tons per hour. This would give the facility the ability to process approximately 480 tons during an eight-hour shift. A general schematic of the picking line is attached.

2) Loading Equipment:

1) Caterpillar 322 Hydraulic Excavator or equal: The primary function of this equipment will be to load material from the tipping area to the feed hopper.
   Pertinent specifications of this equipment include:

   - Maximum operating weight: 35,900 lbs.
   - Gross diesel engine power: 102 HP
   - Minimum bucket size: 0.48 cy
   - Shipping length: 27'-9 ½"
   - Shipping height: 9'-1 25/64"
   - Maximum loading height is approximately 28'
   - Track-based undercarriage

2) Caterpillar Wheel Loader 938 & 950 or equal: The primary function of this piece of equipment will be to push material on the tipping pad towards the excavator and presorted material away from the excavator. In addition, it will be used to load reclaimed and by-pass material on to receiving trucks to be shipped from the site.

   Pertinent specifications of this equipment include:

   - Maximum operating weight: 27,510 lbs.
   - Gross diesel engine power: 137 HP
   - Maximum shipping length with bucket: 24'-5"
   - Shipping height: 10'-8"
   - Maximum loading height is 16'-8"
   - Wheel-based undercarriage

3) Other equipment:

1) A mobile crushing unit will be brought on-site on an as needed basis for crushing concrete.
2) 330-gallon portable water tank: Provide water at various locations.

G) Fire Department Response:

A letter from the City of High Point's Fire Department concerning the ability of the department to respond to an emergency at the facility is included in the Construction Plan Application.

H) Asbestos Containing Materials Management:

Precautions that will be taken to reduce the risk caused by asbestos fibers:

- Incoming trucks will be properly covered.
- The presort area employee will also serve as the asbestos inspector. Inspector duties will include checking each load for possible asbestos containing material. In addition, the inspector will take continuing education courses concerning asbestos

inspection.

- Materials that are suspected of containing asbestos will immediately be dampened until there is no visible dust. The material will then be covered or wrapped in plastic sheeting and segregated from all activities.
- Asbestos containing materials will be moved from the site with the by-pass material to an approved disposal site
- As material is loaded on the in-feed table and prior to entering the vibratory feeders, the material will be subjected to a ULV mister consisting of ultra low volume spray nozzles that will dampen debris, thus minimizing airborne particulate matter.
- Upon discovery of regulated asbestos, the reclamation center will simply alter operations as necessary for the asbestos to be properly removed by a licensed company.
- All facility personnel will be provided protective breathing masks for use while screening or processing waste.

I) Financial Assurances:

The facility proposes to use a financial assurance bond with a company acceptable to the State. This bond will be issued with the Division of Waste Management – Solid Waste Section as the benefactor for the purpose of remedial clean up at the site and will be covered with the on-site landfill.

[END]

RECLAMATION FACILITY

Attachment I - **Load Inspection Form**
Attachment II - **Specifications of Processing Equipment**
Attachment III - **Specifications of Loading Equipment**

Attachment I - Load Inspection Form

LOAD INSPECTION RECORD FORM

MRR of High Point Reclamation Facility

Date:_____ Hauler:_____

Inspector:_____ Load Source:_____

Waste Accepted ( ) Rejected ( ) Held ( )

Agencies Notified:_____

Persons Notified:_____

INSPECTION CHECKLIST:

If "yes please explain in the space provided below

	YES	NO
Asbestos containing material	_____	_____
Material with hazardous placecarding	_____	_____
Household garbage	_____	_____
Containers	_____	_____
Sludges	_____	_____
Biomedical waste	_____	_____
Material with chemical odors, powders, dusts, or vapors	_____	_____
Drums or commercial sized containers	_____	_____
Materials with bright or unusual colors	_____	_____
Household hazardous wastes	_____	_____
Unidentified wastes	_____	_____

Description of materials:_____

_____

_____

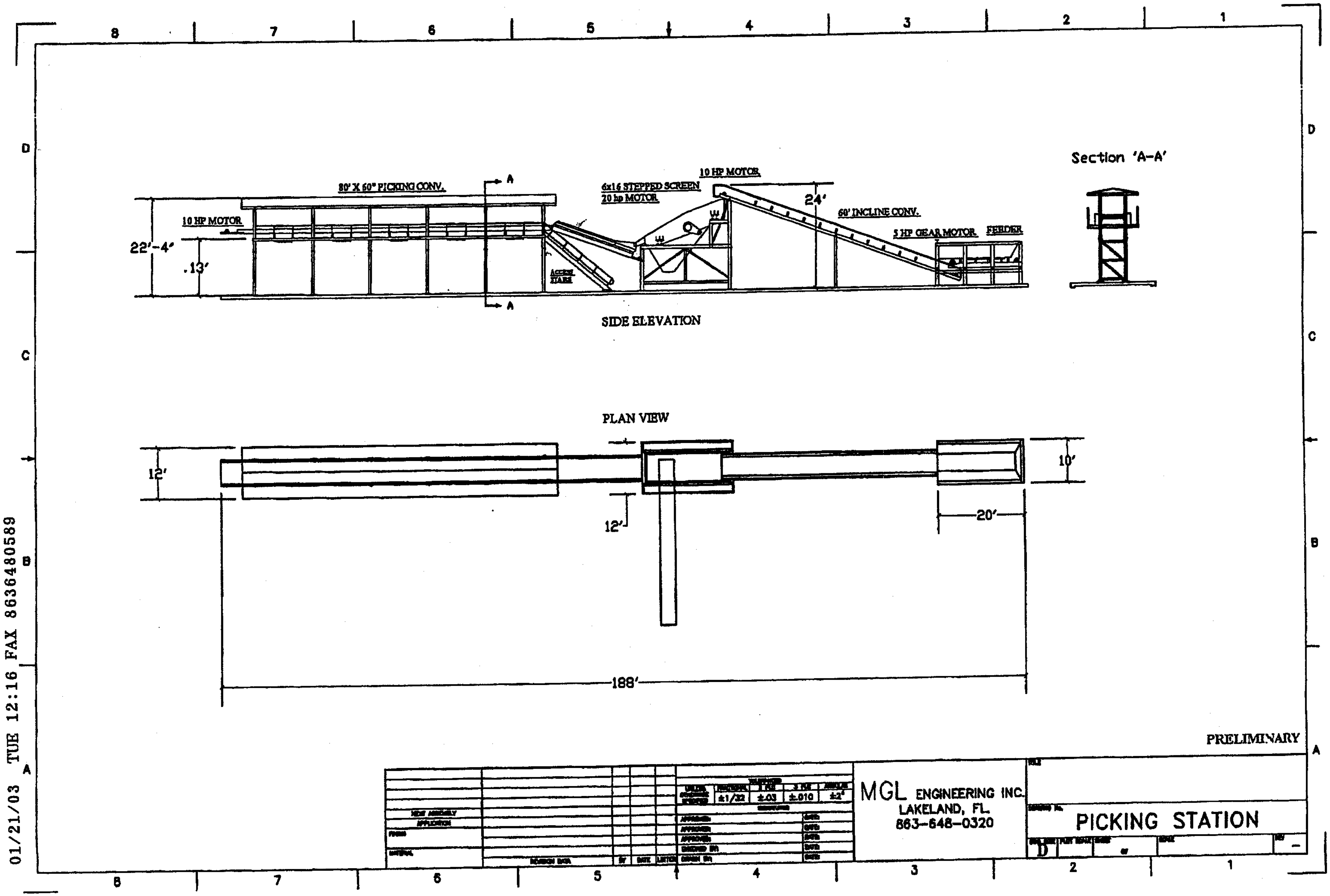
Driver's name and comments (if applicable):_____

_____

_____

Attachment II - Specifications of Processing Equipment

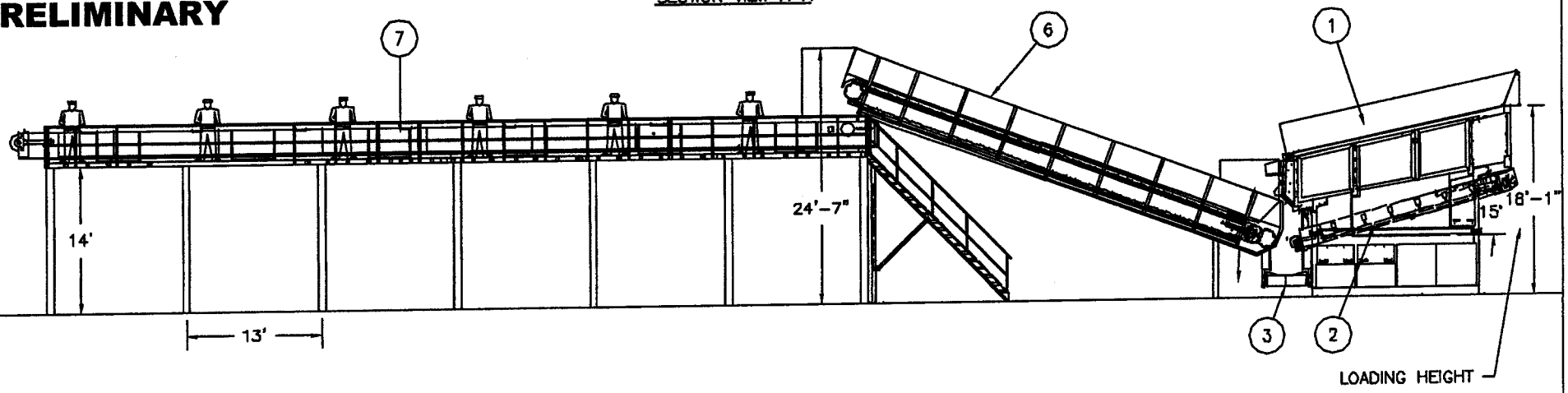
Attachment III - Specifications of Loading Equipment



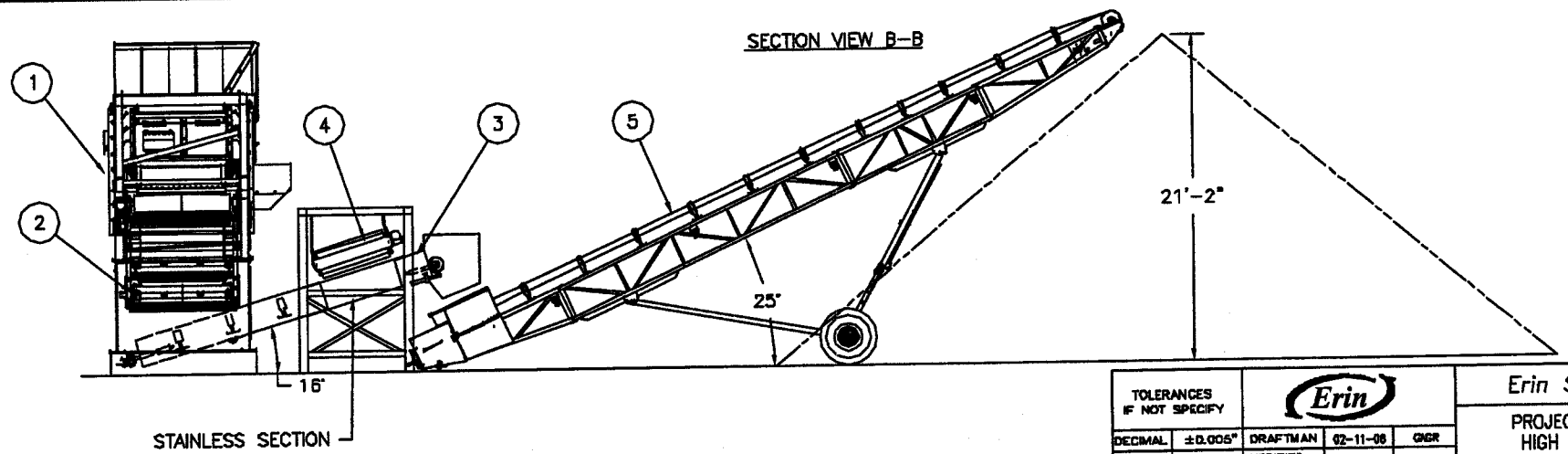
Section 'A-A'
80' X 60" PICKING CONV.
10 HP MOTOR
22'-4'
13'
6x16 STEPPED SCREEN
20 hp MOTOR
10 HP MOTOR
24'
60' INCLINE CONV.
5 HP GEAR MOTOR
FEEDER
ACCESS STAIRS
A
A
SIDE ELEVATION
PLAN VIEW
12'
12'
10'
20'
188'
PRELIMINARY
MGL ENGINEERING INC.
LAKELAND, FL.
863-648-0320
PICKING STATION
±1/32
±.03
±.010
±2°
D

PRELIMINARY

SECTION VIEW A–A



SECTION VIEW B–B



TOLERANCES IF NOT SPECIFY				
DECIMAL	±0.005"	DRAFTMAN	02-11-06	GNGR
FRACT.		VERIFIED		
ANGLE	±.5°	GABARIT		
		SCALE	NTS	
		REF. PART	DESSINS CAO	

Erin

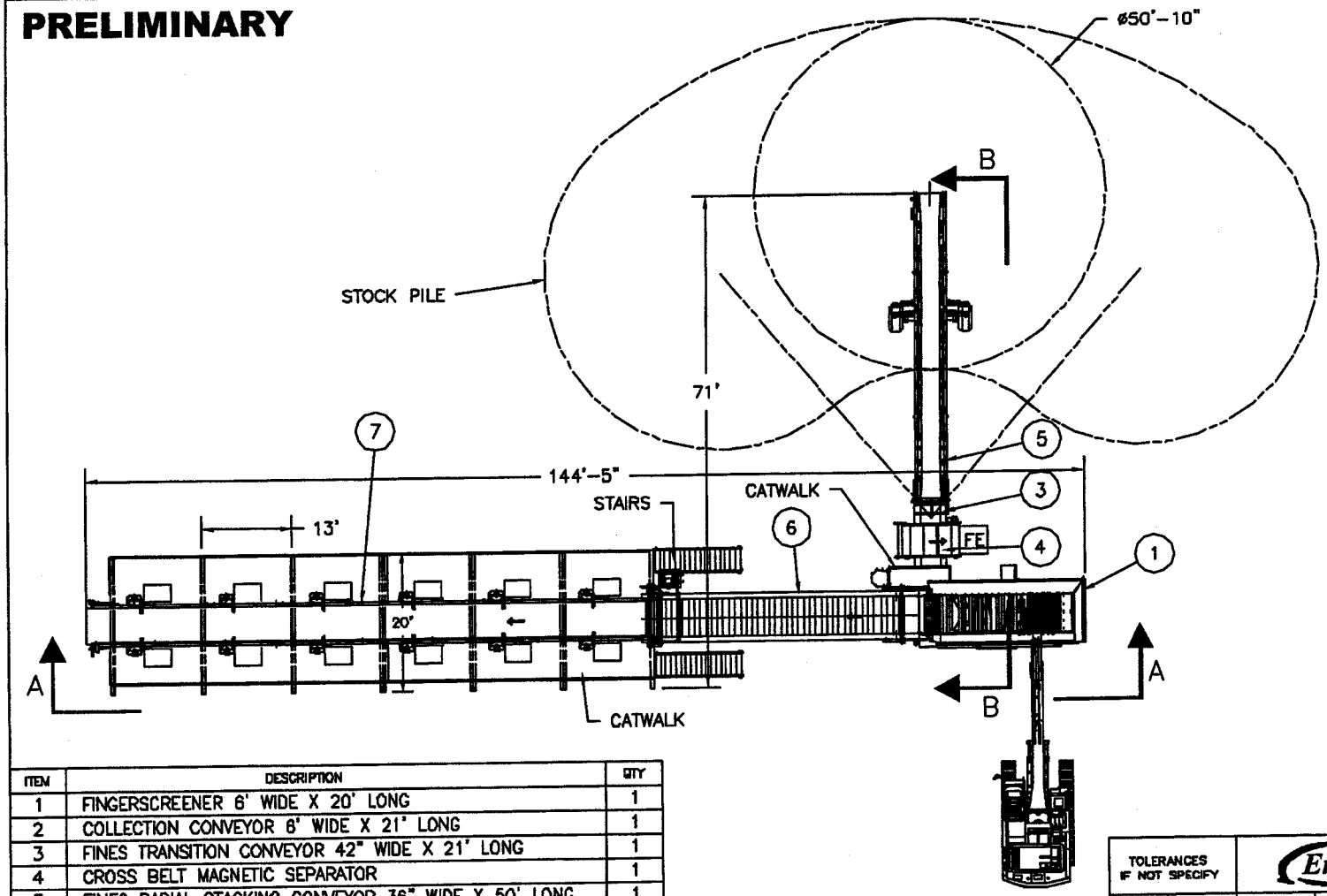
Erin Systems Ltd

PROJECT: D.H. GRIFFIN
HIGH POINT FACILITY
PRELIMINARY LAYOUT

DWG. NO.: --- | DECOUPE: 1

FILE NAME: DH_GRIFFIN_021106 | PAGE: 2/2

PRELIMINARY



ITEM	DESCRIPTION	QTY
1	FINGERSCREENER 6' WIDE X 20' LONG	1
2	COLLECTION CONVEYOR 6' WIDE X 21' LONG	1
3	FINES TRANSITION CONVEYOR 42" WIDE X 21' LONG	1
4	CROSS BELT MAGNETIC SEPARATOR	1
5	FINES RADIAL STACKING CONVEYOR 36" WIDE X 50' LONG	1
6	APPRON CONVEYOR 60" WIDE X 40' LONG	1
7	SORTING STATION 60" WIDE X 79' LONG	1

TOLERANCES IF NOT SPECIFY				
DECIMAL	±0.005"	DRAFTMAN	02-11-06	GAGR
FRACT.		VERIFIED		
ANGLE	±.5°	GABARIT		
		SCALE	NTS	
		REF. PART	DESSINS_CAD	

Erin

Erin Systems Ltd

PROJECT: D.H. GRIFFIN
HIGH POINT FACILITY
PRELIMINARY LAYOUT

DWG no.: ... | DECOUPE 1

FILE NAME: DH_GRIFFIN_021106 | PAGE: 1/2

APPENDIX 1

Property Boundary Survey

APPENDIX 2

Random Waste Screening Forms

1. Waste Inspection Form

2. Refuse/Unidentified Waste Inspection Form

3. USEPA Hazardous Waste Inspection Decision Tree

1. Waste Inspection Form

WASTE INSPECTION FORM

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

Waste Name(s) & Address (es)

1. _____
2. _____
3. _____
4. _____
5. _____

Waste Hauler _____

Address _____

Driver's Name _____

Waste Accepted [ ] Rejected [ ] Held [ ]

NOTIFIED: Waste Source [ ] Hauling Management [ ] Site Management [ ]

State [ ] Federal [ ]

Loader Operator: _____

Personnel Conducting the Inspection: _____

_____

1. Supervisor Conducting the Inspection: _____

SIGNATURE: _____

2. Witness: _____

SIGNATURE: _____

3. Driver: _____

SIGNATURE: _____

4. Other: _____

Company: _____ Title: _____

SIGNATURE: _____

DATE: _____ TIME _____ AM [ ] PM [ ]

ADDITIONAL COMMENTS: on the back

CONTAINER INVENTORY

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

Container:

Drum [ ] Metal [ ] Cardboard [ ] Plastic [ ] Other [ ]

Other: _____

Contents:

1. Full [ ] Partially Full [ ] Empty [ ]
2. Crushed [ ] Punctured [ ]
3. Labeled [ ] Hazardous [ ]

Identified: _____

Additional Information:

Container:

Drum [ ] Metal [ ] Cardboard [ ] Plastic [ ] Other [ ]

Other: _____

Contents:

1. Full [ ] Partially Full [ ] Empty [ ]
2. Crushed [ ] Punctured [ ]
3. Labeled [ ] Hazardous [ ]

Identified: _____

Additional Information:

INSPECTION CHECK LIST:(Check all that apply)

(If "YES" Please explain in the space provided below)

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

	YES	NO
1. Powders/Dusts	____	____
Identified: _____		
Unknown	____	____
2. Unacceptable Saturation	____	____
3. Odor/Fumes	____	____
Strong	____	____
Faint	____	____
Describe: _____		
4. Heat	____	____
Item: _____		
5. Battery	____	____
6. Oil	____	____
7. Biomedical	____	____
8. Radioactivity	____	____
9. Ashes/Residue	____	____
10. Sod/Soil	____	____
11. Asbestos (not properly contained)	____	____
12. PCB	____	____
13. Out of County Waste	____	____

Explanation:

2. Refuse/Unidentified Waste Inspection Form

REFUSE/UNIDENTIFIED WASTE INSPECTION FORM

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

REJECTABLE WASTE DESCRIPTION: _____

_____

_____

_____

WASTE: Rejected [ ] Accepted [ ]

NOTIFIED: [ ] Waste Source [ ] Hauling Management [ ] Federal
[ ] Site Management [ ] State

REFUSED WASTE TRANSPORTED BY:

Hauler Address: _____

_____

Destination: _____

_____

ACCEPTED WASTE:

Contained area: _____

Secured by: _____

Lab to complete testing: _____

ADDITIONAL COMMENTS: _____

_____

_____

3. USEPA Hazardous Waste Inspection Decision Tree

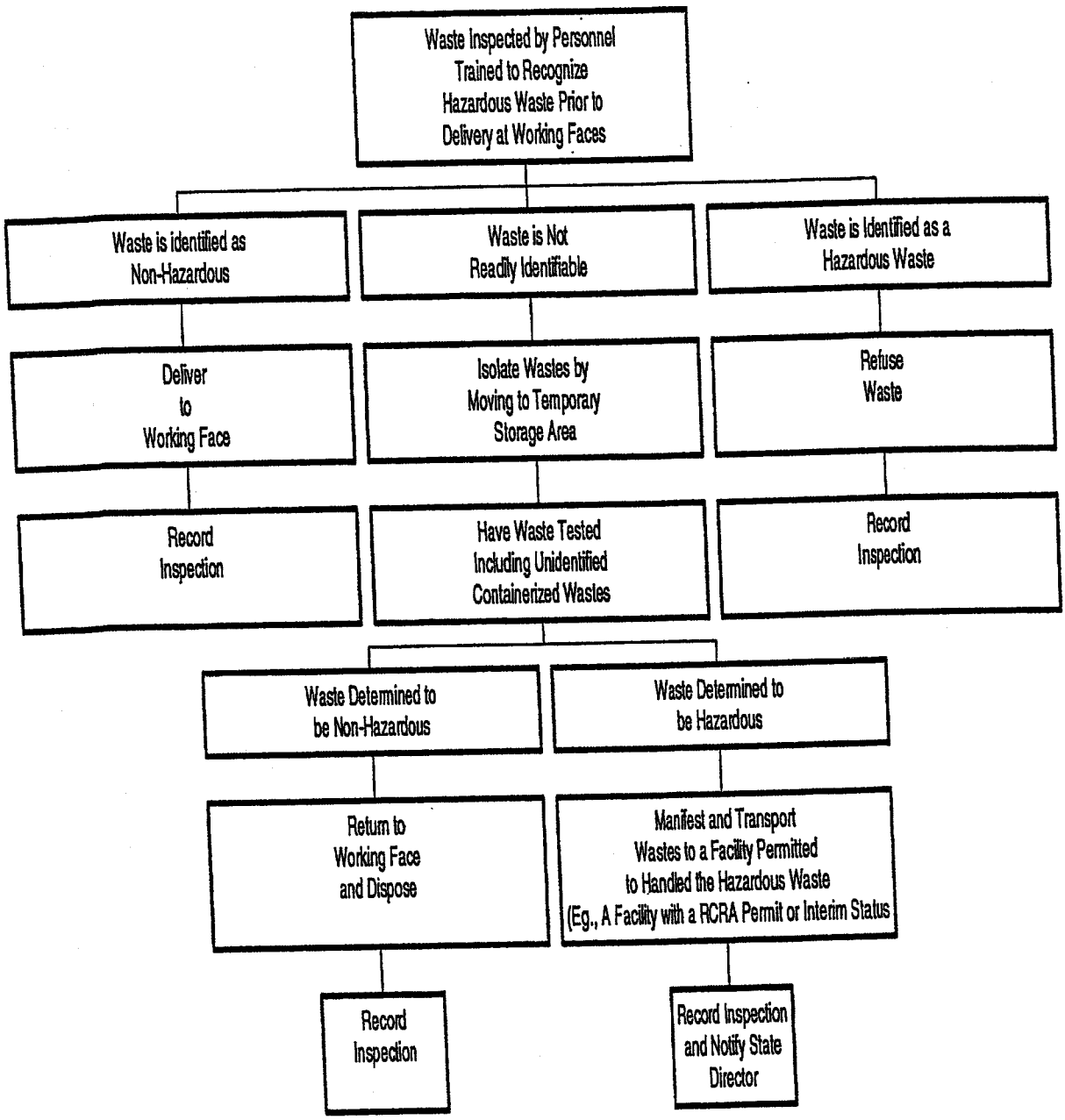


Figure 3-1
Hazardous Waste Inspection Decision Tree
Inspection Prior to Working Face

Source: EPA "Solid Waste Disposal Facility Criteria – Technical Manual". Nov. 1993

APPENDIX 3

Seeding Specifications

SECTION 02936

SEEDING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Preparation of subsoil

B. Placing topsoil material

C. Fertilizer and lime

D. Seedbed preparation

E. Temporary seeding in late winter and early spring.

F. Temporary seeding in fall and early winter

G. Permanent seeding and mulching

1.02 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, the weight, date of packaging, and location of packaging.

1.03 MAINTENANCE DATA

A. Submit maintenance data for continuing Owner maintenance.

B. Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.04 DELIVERY, STORAGE AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging will not be acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

D. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

E. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible.

1.05 WARRANTY

A. Submit written warranty from Seeding Contractor. The warranty shall provide for the establishment of a healthy stand of grass on all seeded areas for a period of at least one year.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. Topsoil Material: Excavated from site and free of weeds.

2.02 ACCESSORIES

A. Mulching material: Oat or wheat straw, dry, free from weeds and foreign matter detrimental to plant life.

B. Lime: Lime shall comply with applicable North Carolina state laws and shall be delivered in unopened bags or other convenient standard containers, each fully labeled with the manufacturer's guaranteed analysis. Lime shall be ground limestone containing not less than 85 percent total carbonates, and shall be ground to such fineness that 90 percent by weight will pass through a No. 20 mesh sieve and 50 percent by weight will pass through a No. 100 mesh sieve.

C. Fertilizer: Fertilizer shall comply with applicable North Carolina state laws and shall be delivered in unopened bags or other convenient standard container, each fully labeled with the manufacturer's guaranteed analysis. Fertilizer shall contain not less than 10 percent nitrogen, 10 percent available phosphoric acid and 10 percent water soluble potash (N-P-K, 10-10-10). Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be acceptable and shall be immediately removed from the job site.

PART 3 EXECUTION

3.01 GENERAL

A. Areas where topsoil material is to be placed and areas to be seeded include all areas that will be disturbed during construction.

B. Verify that prepared soil base is ready to receive the work of this Section.

3.02 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil.

C. Scarify subsoil to a depth of 3 inches where topsoil material is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.03 PLACING TOPSOIL MATERIAL

A. Place topsoil material during dry weather and on dry unfrozen subgrade 2 to 3 weeks prior to sowing seed.

B. Spread topsoil material over area to be seeded. Finished thickness of topsoil material shall be 3 inches minimum after settling and nominal compaction caused by spreading equipment.

C. Grade to eliminate rough, low, or soft areas, and to ensure positive drainage.

D. Rake topsoil material and remove roots, vegetable matter, rocks, clods, and other foreign non-organic material.

3.04 FERTILIZER AND LIME

A. Apply lime and fertilizer according to soil tests, or apply lime at the rate of 90 lbs./1000 sq.ft. and fertilizer at the rate of 20 lbs./1000 sq.ft.

B. Mix thoroughly into upper 4 inches of topsoil.

C. Lightly water to aid the dissipation of fertilizer and lime.

3.05 SEEDBED PREPARATION

A. Prepare seedbed to a depth of 4 to 6 inches.

B. Remove loose rocks, roots and other obstructions so that they will not interfere with the establishment and maintenance of vegetation.

3.06 TEMPORARY SEEDING IN LATE WINTER AND EARLY SPRING

A. Provide temporary seeding on any cleared, unvegetated, or sparsely vegetated soil surface where vegetative cover is needed for less than one year or when seeding dates will prevent

the establishment of vegetative cover if permanent seeding is attempted. Seed and mulch within15 working days following completion of any phase of grading.

B. Seed in accordance with the following schedule and application rates:

Seeding Dates	Seeding Mixture Species and Application Rate
January 1 to May 1	Winter Rye (grain) at 120 lbs/acre, and Kobe lespedeza at 50 lbs/acre.

C. To amend soil, follow recommendations of soil tests or apply 2,000 lbs./acre ground agricultural limestone and 750 lbs./acre 10-10-10 fertilizer.

D. Mulch by applying 4,000 lb/acre straw. Anchor by tacking with netting or a mulch anchoring tool.

E. Refertilize if growth is not fully adequate.

F. Reseed, refertilize and mulch immediately following erosion or other damage.

3.07 TEMPORARY SEEDING IN FALL AND EARLY WINTER

A. Provide temporary seeding on any cleared, unvegetated, or sparsely vegetated soil surface where vegetative cover is needed for less than one year or when seeding dates will prevent the establishment of vegetative cover if permanent seeding is attempted. Seed and mulch within 15 working days following completion of any phase of grading.

B. Seed in accordance with the following schedule and application rates:

Seeding Dates	Seeding Mixture Species and Application Rate
August 15 to December 30	Winter Rye (grain) at 120 lbs/acre

C. To amend soil, follow recommendations of soil tests or apply 2,000 lbs./acre ground agricultural limestone and 1,000 lbs./acre 10-10-10 fertilizer.

D. Mulch by applying 4,000 lb/acre straw. Anchor by tacking with netting or a mulch anchoring tool.

E. Refertilize if growth is not fully adequate.

3.08 PERMANENT SEEDING

A. Seed and mulch all disturbed areas within 15 working days or 90 calendar days (whichever is shorter following completion of construction or development.

B. Amend soil by applying lime and fertilizer according to soil tests, or apply 4,000 lbs/acre ground agricultural limestone and 1,000 lbs/acre 10-10-10 fertilizer.

C. Seed grass-lined channels in accordance with the following schedule and application rates:

Seeding Dates	Seeding Mixture Species and Application Rate
Feb. 1 – April 15 or Aug. 25 – Oct. 25	Tall fescue at 200 lbs/acre

D. Mulch channel side slopes above the temporary lining by applying 4,000 lbs/acre grain straw. Anchor straw by stapling netting over the top.

E. Seed other areas having slopes steeper than 3:1 in accordance with the following schedule and application rates:

Seeding Dates	Seeding Mixture Species and Application Rate
Feb. 1 – April 15 or Aug. 20 – Oct. 25	Tall fescue at 100 lbs/acre, Sericea lespedeza at 30 lbs/acre, and Kobe lespedeza at 10 lbs/acre.

F. Mulch steep slopes by applying 4,000 – 5,000 lbs/acre grain straw or equivalent cover of another suitable material. Anchor mulch by tacking with netting.

G. Seed areas having gentle slopes (3:1 or less) in accordance with the following schedule and application:

Seeding Dates	Seeding Mixture Species and Application Rate
Feb. 1 – April 15 or Aug. 20 – Oct. 25	Tall fescue at 80 lbs/acre, Sericea lespedeza at 20 lbs/acre, and Kobe lespedeza at 10 lbs/acre.

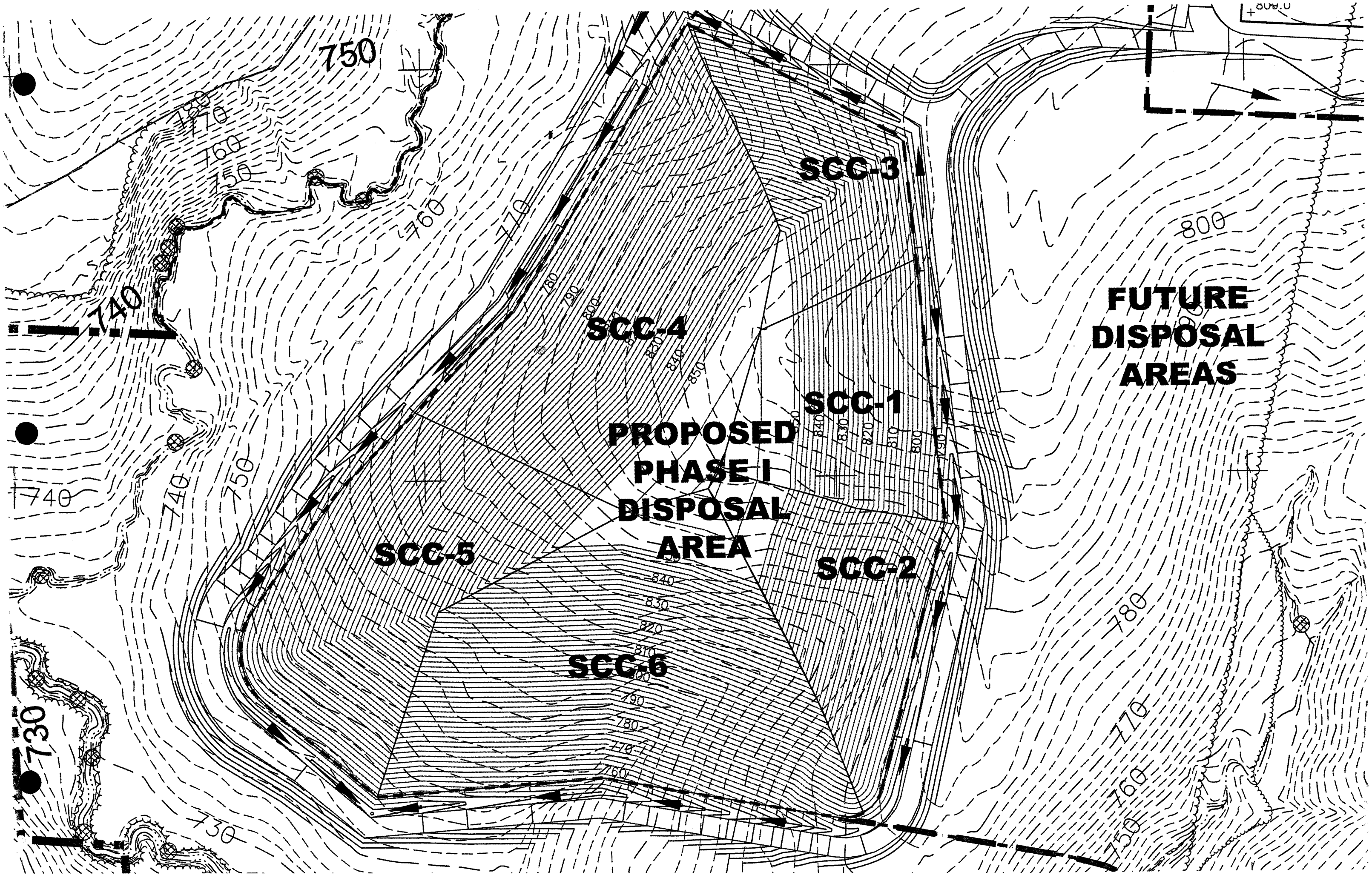
H. Mulch gentle slopes by applying 4,000 lbs/acre grain straw or equivalent cover of another suitable mulch. Anchor straw by tacking with netting, roving, or by crimping with a mulch-anchoring tool.

I. Refertilize in the second year unless growth is fully adequate. Reseed, refertilize, and mulch damaged areas immediately.

END OF SECTION

APPENDIX 4

Erosion and Sediment Control Plan


SCC-3
SCC-4
SCC-1
SCC-5
SCC-2
SCC-6
PROPOSED
PHASE I
DISPOSAL
AREA
FUTURE
DISPOSAL
AREAS
740
750
760
770
780
790
800
810
820
830
840
850

SCC-1
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.036700	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	9.52	cfs

Results		
Depth	0.36	ft
Flow Area	2.22	ft^2
Wetted Perimeter	7.30	ft
Top Width	7.19	ft
Critical Depth	0.44	ft
Critical Slope	0.018827	ft/ft
Velocity	4.29	ft/s
Velocity Head	0.29	ft
Specific Energy	0.65	ft
Froude Number	1.36	
Flow is supercritical.		

SCC-2
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-2
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.021300	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	14.16	cfs

Results		
Depth	0.53	ft
Flow Area	3.50	ft^2
Wetted Perimeter	8.36	ft
Top Width	8.19	ft
Critical Depth	0.56	ft
Critical Slope	0.017652	ft/ft
Velocity	4.05	ft/s
Velocity Head	0.25	ft
Specific Energy	0.79	ft
Froude Number	1.09	
Flow is supercritical.		

SCC-3
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-3
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.041300	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	3.92	cfs

Results		
Depth	0.21	ft
Flow Area	1.19	ft^2
Wetted Perimeter	6.33	ft
Top Width	6.27	ft
Critical Depth	0.25	ft
Critical Slope	0.021962	ft/ft
Velocity	3.30	ft/s
Velocity Head	0.17	ft
Specific Energy	0.38	ft
Froude Number	1.34	
Flow is supercritical.		

SCC-4
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-4
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.018100	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	15.23	cfs

Results		
Depth	0.58	ft
Flow Area	3.89	ft^2
Wetted Perimeter	8.66	ft
Top Width	8.47	ft
Critical Depth	0.58	ft
Critical Slope	0.017449	ft/ft
Velocity	3.91	ft/s
Velocity Head	0.24	ft
Specific Energy	0.82	ft
Froude Number	1.02	
Flow is supercritical.		

SCC-5
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-5
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.035000	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	22.98	cfs

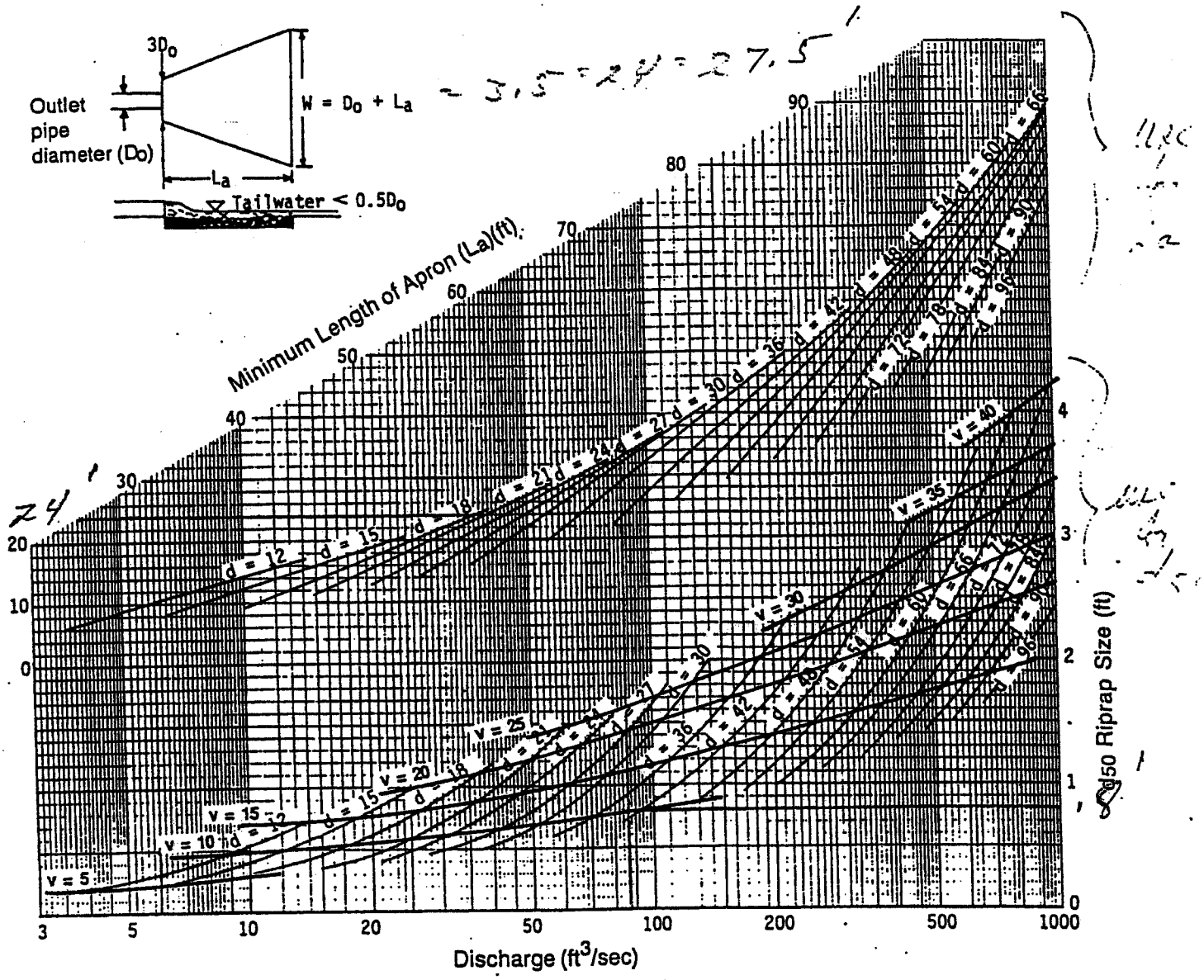
Results		
Depth	0.60	ft
Flow Area	4.12	ft^2
Wetted Perimeter	8.82	ft
Top Width	8.63	ft
Critical Depth	0.74	ft
Critical Slope	0.016376	ft/ft
Velocity	5.58	ft/s
Velocity Head	0.48	ft
Specific Energy	1.09	ft
Froude Number	1.42	
Flow is supercritical.		

SCC-6
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-6
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.047200	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	26.10	cfs

Results		
Depth	0.60	ft
Flow Area	4.06	ft^2
Wetted Perimeter	8.78	ft
Top Width	8.58	ft
Critical Depth	0.80	ft
Critical Slope	0.016064	ft/ft
Velocity	6.43	ft/s
Velocity Head	0.64	ft
Specific Energy	1.24	ft
Froude Number	1.65	
Flow is supercritical.		

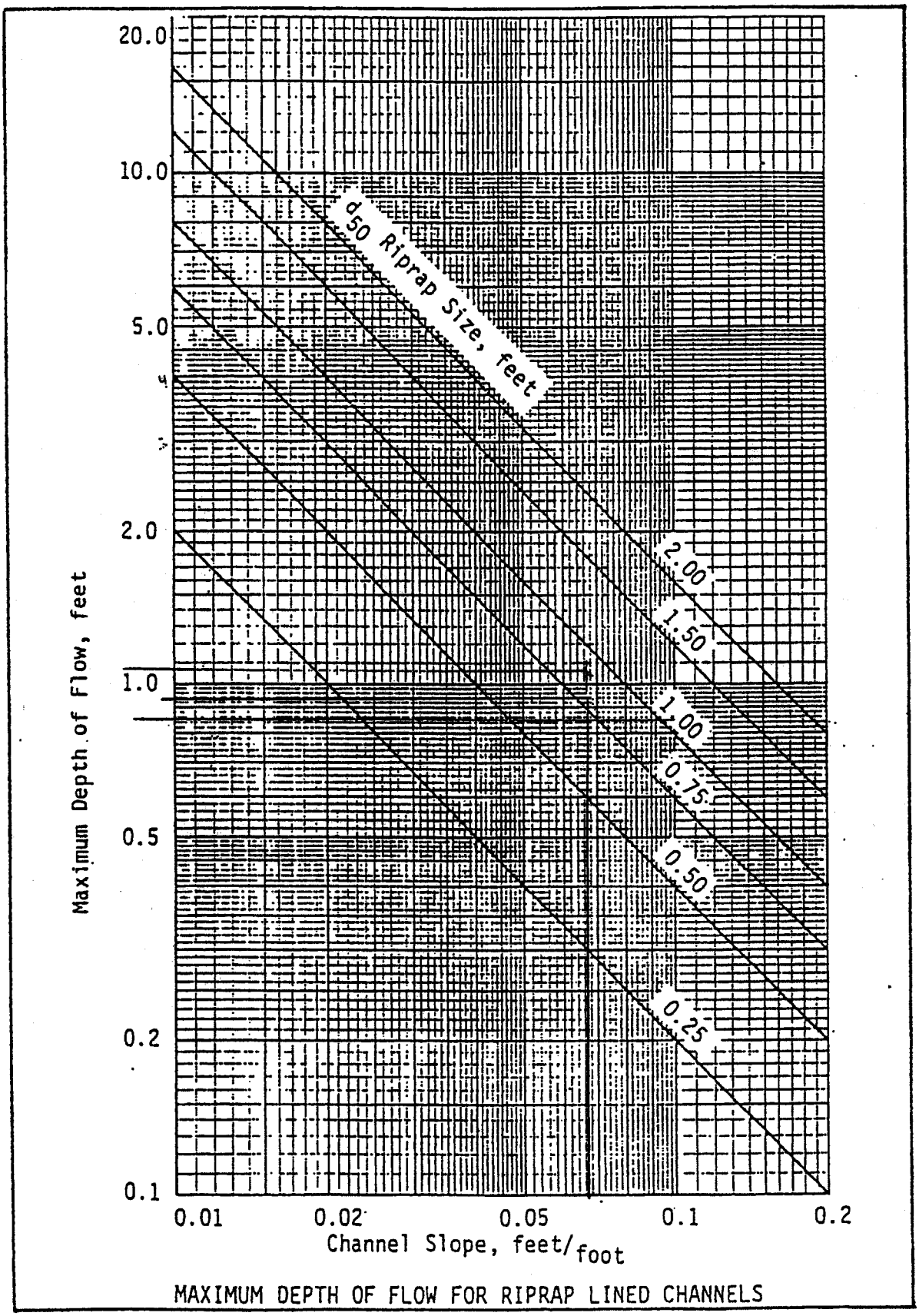


Curves may not be extrapolated.

Figure 8.06a Design of outlet protection protection from a round pipe flowing full, minimum tailwater condition (T_w < 0.5 diameter).

SIZING OF RIPRAP

1992



MAXIMUM DEPTH OF FLOW FOR RIPRAP LINED CHANNELS

Source: VDOT Drainage Manual

CHANNEL 5 $D_{50} = 0.75'(9")$

CHANNEL 6 $D_{50} = 1.00'(12")$

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job MRR-HP

Job No. 600.06 Sheet No. 1 of

Calculated by MDE Date 1/22/03

Checked by Date

Subject Disposal Area Drainage Scale

CHANNEL	A (acres) AREA	C	I (25yr) INTENSITY	SLOPE	Q (cfs)	T_c Time of Concentration
SCC-1	2.60	.60	6.1	0.0367	9.52	10.85
SCC-2	1.27	.60	6.1	0.0213	4.65	11.08
SCC-3	1.07	.60	6.1	0.0413	3.92	10.20
SCC-4	3.09	.60	6.1	0.0181	11.31	7.85
SCC-5	2.12	.60	6.1	0.0350	7.76	11.25
SCC-6	3.26	.60	6.1	0.0472	11.93	10.95

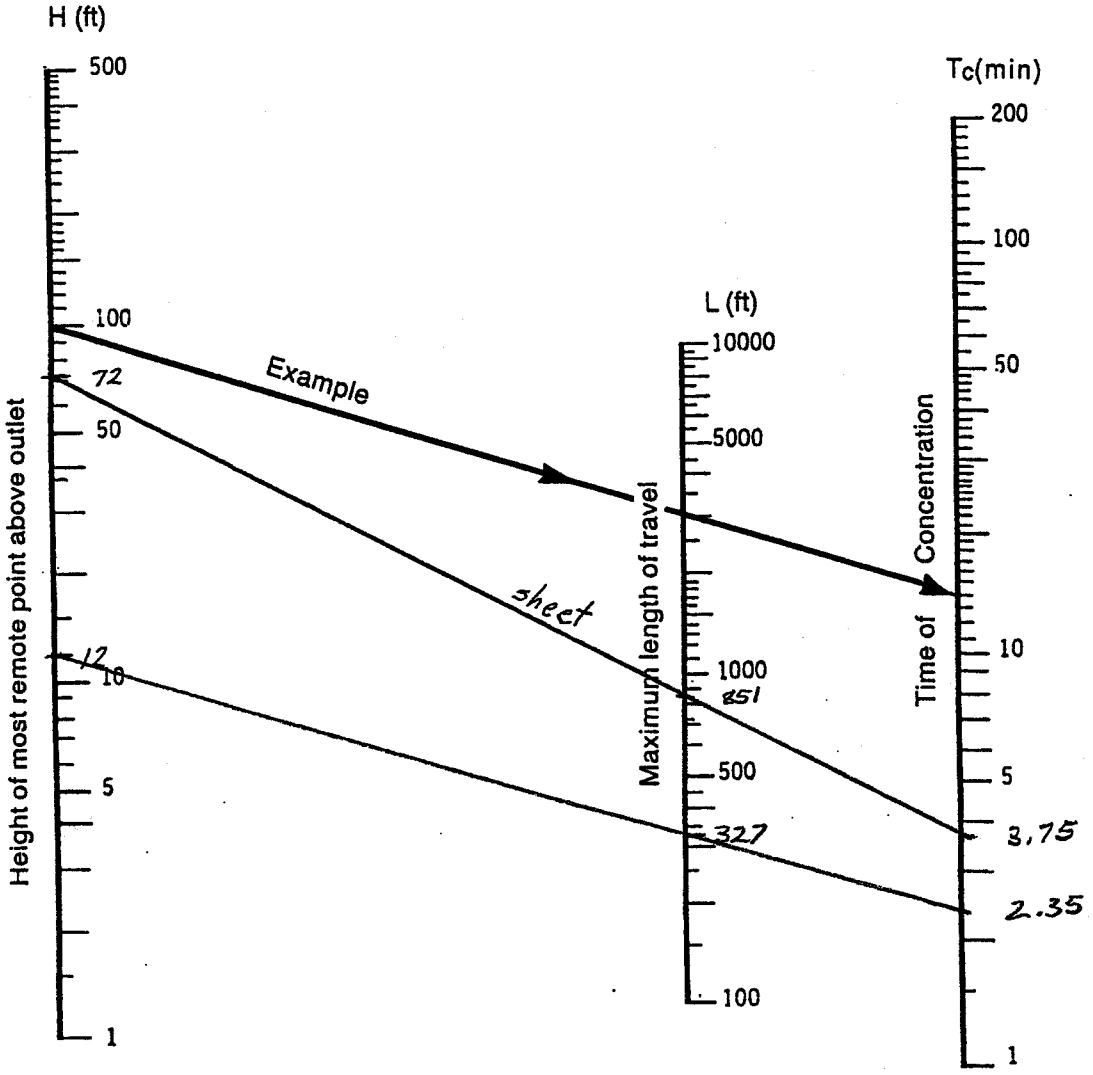
Channel	Contributing Drainage Area	Area (Acres)	Q	V
1	1	2.60	9.52	4.29
2	1,2	3.87	14.16	4.05
3	3	1.07	3.92	3.30
4	3,4	4.16	15.23	3.91
5	3,4,5	6.28	22.98	5.58
6	1,2,6	7.13	26.10	6.43

- All channels are Trapezoidal with 3H:1V – 2' deep, 5' base (cross-sectional area = 22 ft²)
- R = 1.25
- n = 0.030

8

SCC-1 & Area

327 ft, slope 3.67%



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. → 3.75 min X 2 = 7.50 min. sheet
3.35 ditch
10.85 min

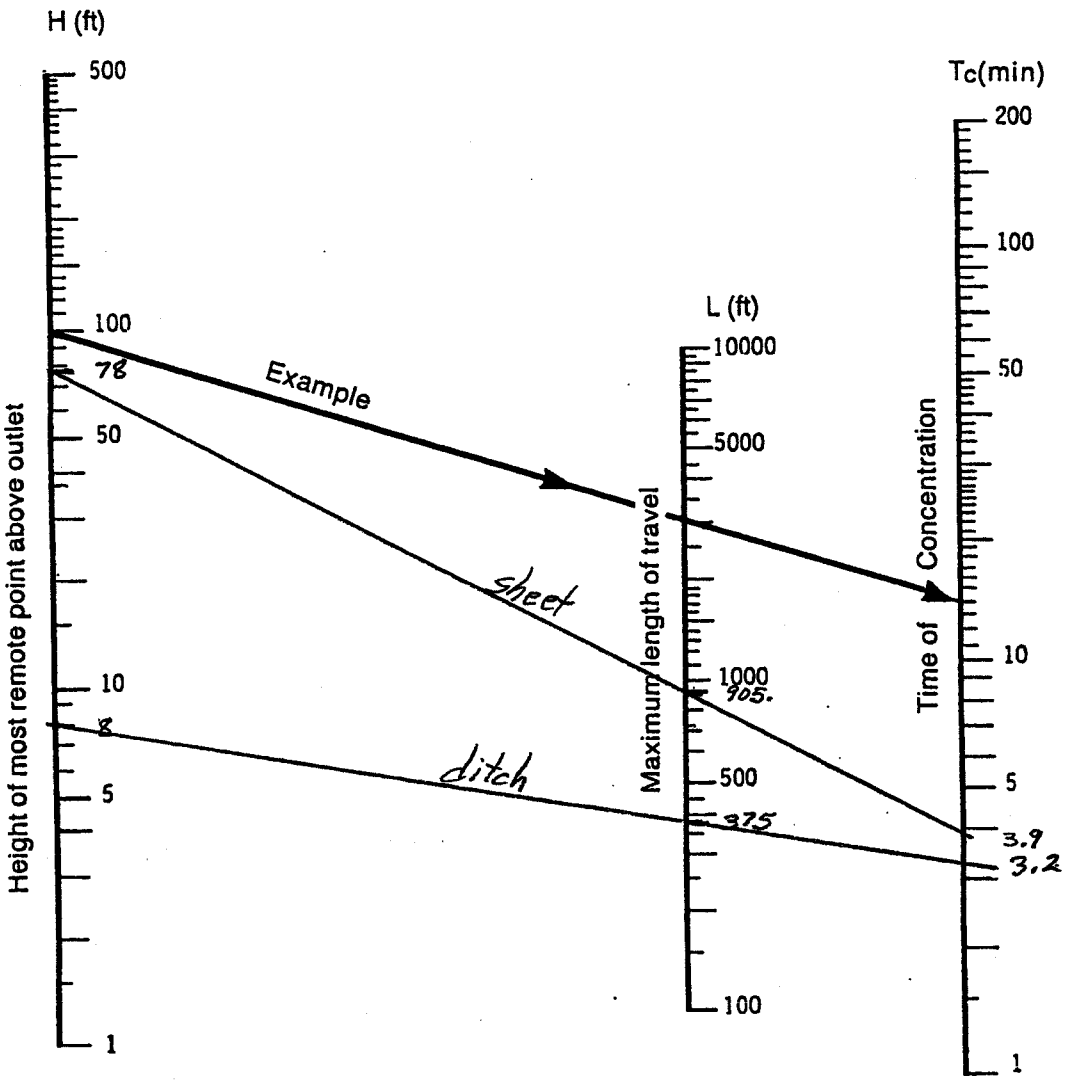
For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

SCC-2 Area

375 ft, slope 2.13%



Note: ·
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. → 3.9 x 2 = 7.8 min. sheet

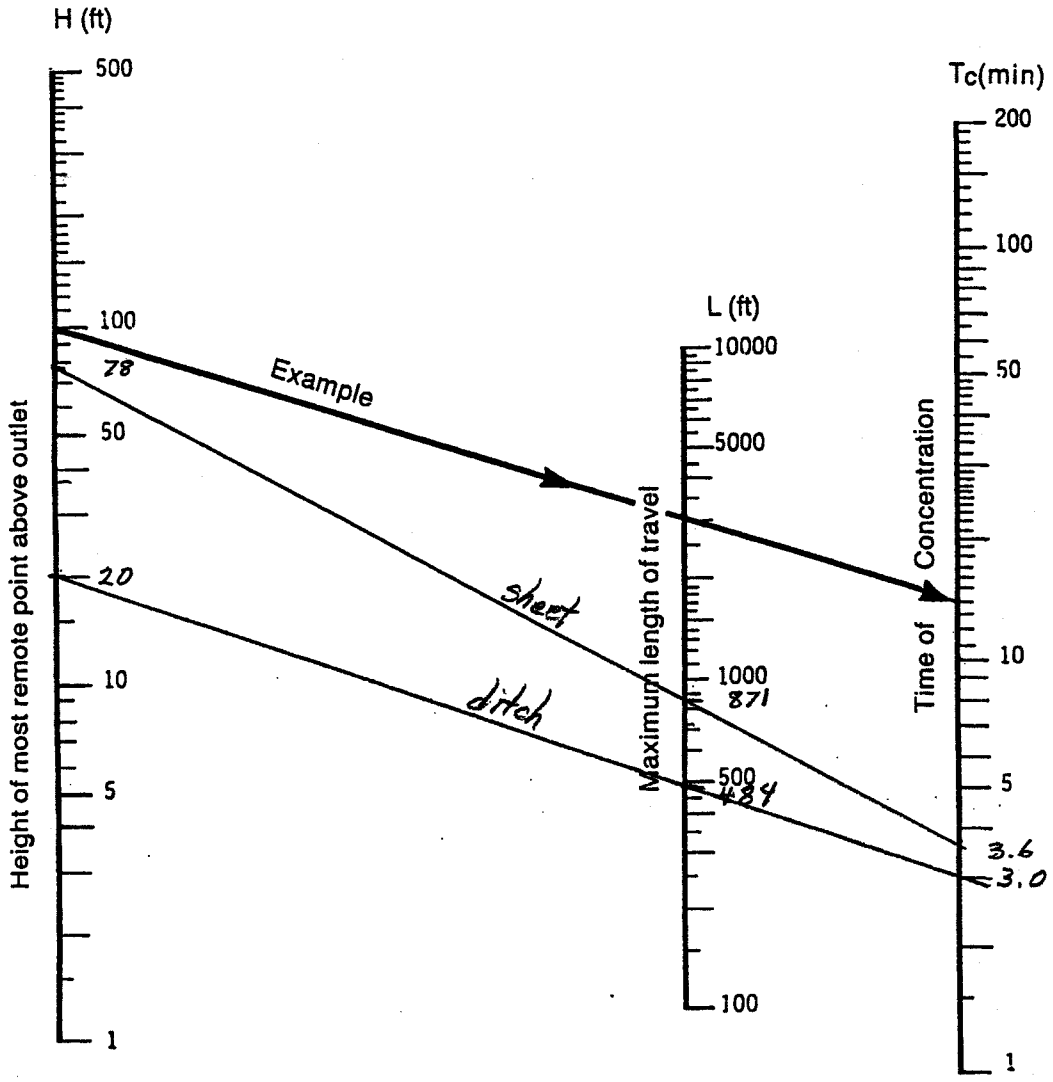
3.2 min. ditch

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4. 11.0 min

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

SCC-3 Area
484 ft, slope 4.13%



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. → 3.6 min. X 2 = 7.2 min sheet
3.0 min. ditch
10.2 min

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

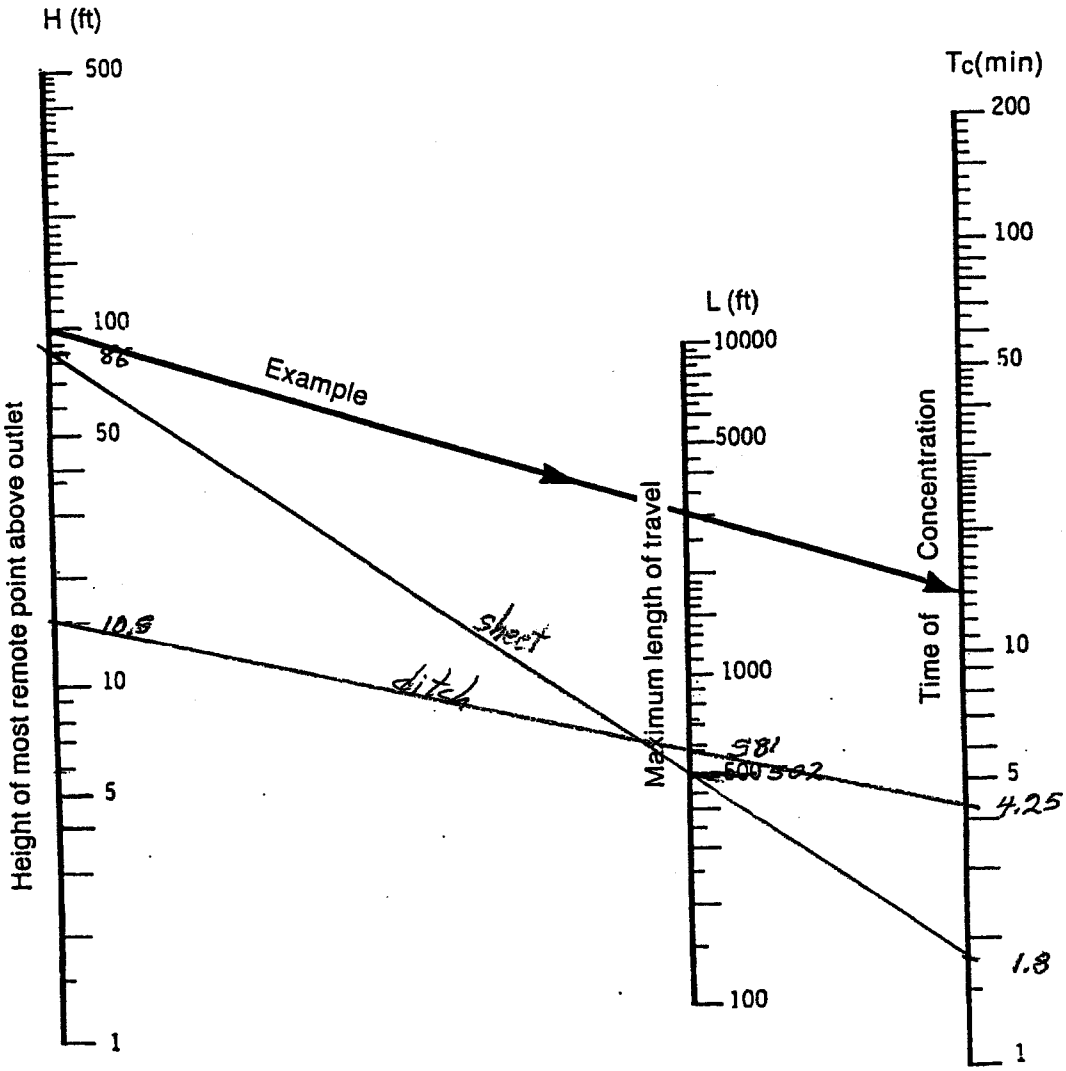
For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

8

SCC-4 Area

581 ft, Slope 1.81%



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. → 1.8 min × 2 = 3.6 min sh
4.25 min dit
7.85 min

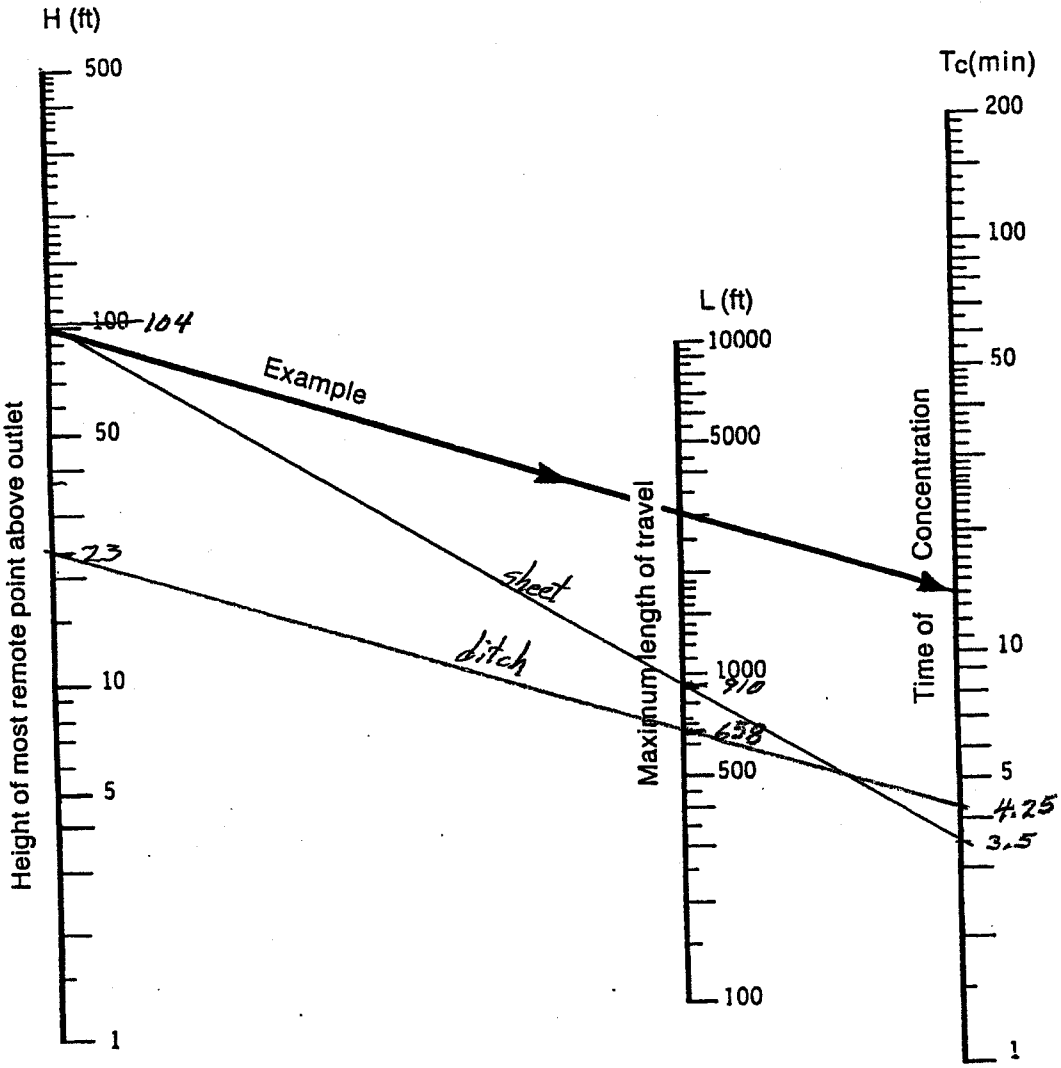
For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

SCC-5 Area

658 ft, slope 3.50%



Note: ·
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. → 3.5 min X 2 = 7.0 min sheet

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

4.25 min ditch

11.25 min

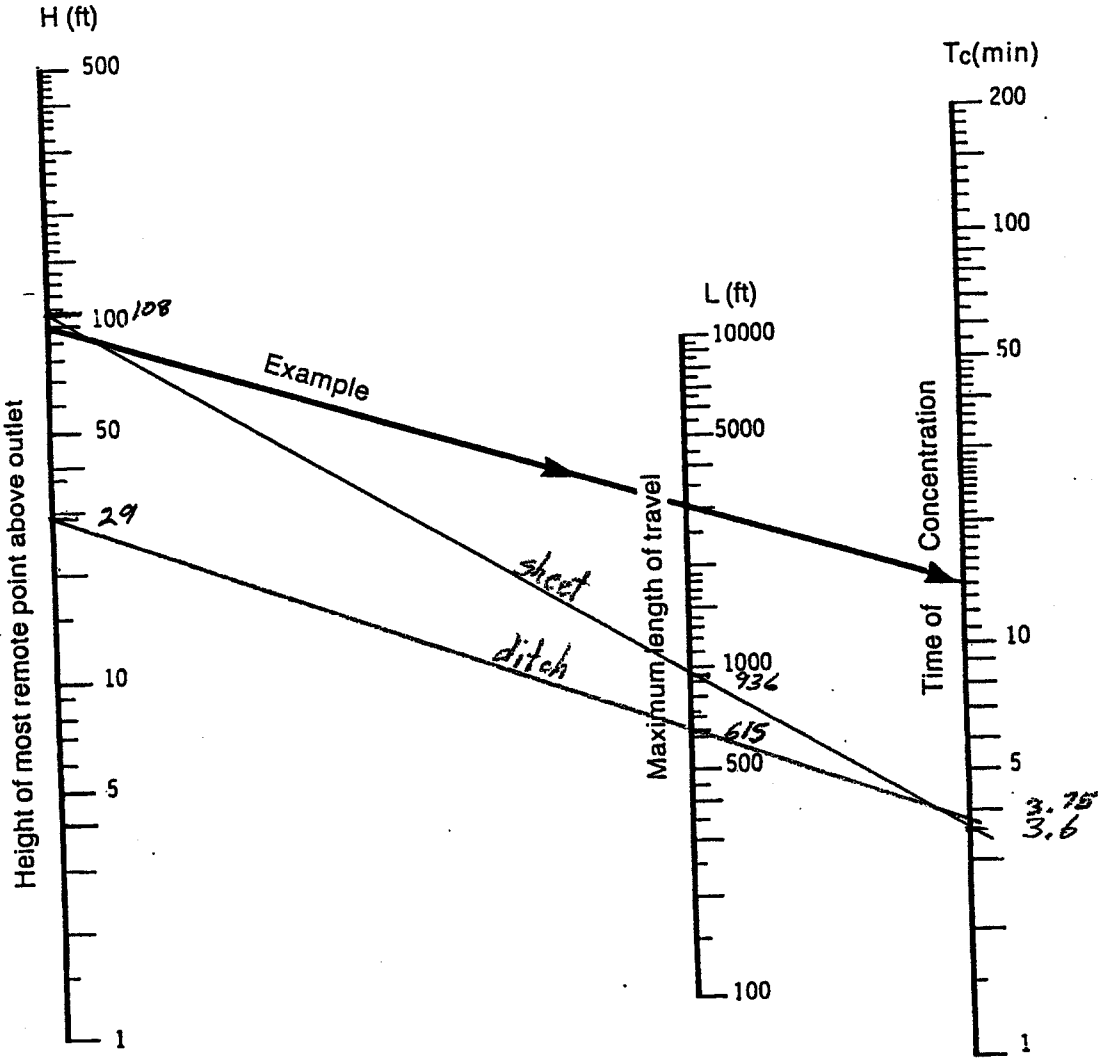
For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

8

SCC-6 Area

625 ft, slope 4.72%



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. → 3.6 X 2 = 7.2 min, sheet

3.75 min. ditch

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4. 10.95

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job

Job No. Sheet No. 1 of

Calculated by QSL Date 6/26/02

Checked by Date

Subject SK-3 Scale

Tot. Planning Area = ~26.7 acre

% Built upon area = 100%

Calc. pre-Compaction required for 100% built upon area, 4' depth.

Ref. p. 8, High Point Stormwater BMP Design Manual

Ratio = 3.25 when entire tot. 100% built upon

26.7 ac. X 0.0325 = 0.868 ac.

Increase by 20% to meet Condition B of Sheet 8

Use Limit ⇒ 1.2 X 0.868 ac = 1.04 ac.

Calc. Composite Curve No.

		CN
Grass	26.2 ac	74
Gravel (33.5 × 50'/in × 13' = 20,100 ft² :	0.5 ac	89

$$\text{Composite CN} = \frac{(74)(26.2) + 89(0.5)}{26.7} = 74.3$$

$$\text{Runoff-Curve } Q = \frac{(P - I_a)^2}{(P - I_a) + S}, \quad S = \frac{1000}{CN} - 10 = 3.46$$

$$I_a = 0.2S = 0.2 \times 3.46 = 0.69$$

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job _____

Job No. _____ Sheet No. 2 of _____

Calculated by _____ Date _____

Checked by _____ Date _____

Subject CA-3 Scale _____

$Q = \frac{(1-0.69)}{(1-0.69)+3.46} = 0.025$ "

Total volume of runoff = $\frac{0.025" \times 26.7 \text{ ac.}}{12 \text{ in/ft.}}$

$= 0.056$ ac-ft.

Min. the volume to be provided by temporary water quality storage at normal pool elev.

Depth = $\frac{0.056 \text{ ac-ft.}}{1.04 \text{ ac.}} = 0.054'$ say 0.06', use 0.1'

Calc. required storage requirement

Provide 0.5 ac-in storage for each disturbed acre draining to the basin. Disturbed area = 26.7 ac

Used = 0.5 in × 26.7 ac = 13.35 ac-in.

$\frac{13.35 \text{ ac-in}}{0.9 \text{ ac.}} = 14.83" = 1.2'$

JOYCE ENGINEERING, INC

Waste Industry Experts

Job

Job No. Sheet No. 3 of

Calculated by Date

Checked by Date

Subject SB-3 Scale

Base of Liner	
Bottom of Pond	724.0
Top of Permanent Sediment Storage	725.2
Top of Permanent Water Quality Storage	729.2
Top of Temporary Water Quality Storage	729.3
Crest of emergency spillway	730.6
100-year peak flow elev.	731.5
Top of Berm	732.5

Q_{P_2} = 43 cfs

$Q_{P_{10}}$ = 86 cfs

$Q_{P_{25}}$ = 107 cfs.

$Q_{P_{100}}$ = 151 cfs.

Select Travel for Q_{10} = 8.6 cfs.

Outlet E = Inv. = 720.0

H = 729.5 − (720.0 + 3.5 (1½" diameter pipe))

= 6.0'

Capacity = 101 cfs. from Table 8.07a

Select min. dia. 72" pipe

Cross-sectional area of travel = 138.5 in.²

Cross-sectional area of pipe = 407 in.²

Ratio = 407/138.5 = 2.94 - O.K.

Check flood at exit

$Q = 3.1LH^{3/2}$

$H^{3/2} = \frac{86}{3.1L}$; L = 18.85

H = 1.3'

Find depth of flow at Emergency spillway exit for 24' wide spillway. Flow through principal spillway: 8.6 cfs. Flow over spillway = 151-86 = 65 cfs.

$H^{3/2} = \frac{65}{3.1L} = \frac{65}{3 \times 24} = 0.93$

H = 0.93'

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job

Job No. Sheet No. 5 of

Calculated by Date

Checked by Date

Subject SA-3 Scale

Select types & provide 5-day shutdown period.
Use 3/4" holes. Cross-sectional area of hole = 0.00306 ft.²

$A_{s\,required} = \frac{A_s\sqrt{2h}}{F_d 20,428}$, Let T = 5 layers = 120 hours

A_s = surface area = 1,044 ac = 45,702 ft.²

h = max. fuel above hole = 0.1 ft.

$A_o = \frac{45702\sqrt{2\times 0.1}}{120\times 0.6\times 20,428}$

= 0.0139 ft.²

$\frac{0.0139\ ft^2\ required}{0.00306\ ft^2/hole}$ = 5 holes needed.

Applied Use Tank

Find surface ft. of water displaced by 72" max.

Wt. of water displaced = $\pi(3)^2(729.3-727.0)(62.4)$
= 12880 #

1.1 X 12880 = 14168 #

Volume of fuel required = $\frac{14168}{(151-62.4)}$ = 160 ft.³

Use tank 24' tall X 9' diam.

SB-3

Table 8.07a
Pipe Flow Chart for Design of Corrugated Metal Outlet Conduit
(Q in cubic ft/sec)

For Corrugated Metal Pipe Inlet $K_e + K_b = 1.0$ and 70 feet of Corrugated Metal Pipe Conduit n = 0.025. Note correction factors for other pipe lengths.

Dia. / H	12"	15"	18"	21"	24"	30"	36"	42"
2	2.84	4.92	7.73	11.30	15.60	26.60	40.77	58.12
3	3.48	6.03	9.47	13.84	19.10	32.58	49.93	71.19
4	4.02	6.96	10.94	15.98	22.06	37.62	57.66	82.20
5	4.49	7.78	12.23	17.87	24.66	42.06	64.46	91.90
6	4.92	8.52	13.40	19.57	27.01	46.07	70.60	100.65
7	5.32	9.21	14.47	21.14	29.19	49.77	76.28	108.75
8	5.68	9.84	15.47	22.60	31.19	53.19	81.53	116.23
9	6.03	10.44	16.41	23.97	33.09	56.43	86.49	123.30
10	6.36	11.00	17.30	25.26	34.88	59.48	91.16	129.96
11	6.67	11.54	18.14	26.50	36.59	62.39	95.63	136.33
12	6.96	12.05	18.95	27.68	38.21	65.16	99.87	142.37
13	7.25	12.55	19.72	28.81	39.77	67.83	103.96	148.21
14	7.52	13.02	20.47	29.90	41.27	70.39	107.88	153.80
15	7.78	13.48	21.19	30.95	42.72	72.85	111.66	159.18
16	8.04	13.92	21.88	31.96	44.12	75.24	115.32	164.40
17	8.29	14.35	22.55	32.94	45.48	77.55	118.87	169.46
18	8.53	14.77	23.21	33.90	46.80	79.81	122.33	174.39
19	8.76	15.17	23.84	34.83	48.08	81.99	125.67	179.15
20	8.99	15.56	24.46	35.73	49.33	84.12	128.93	183.80
21	9.21	15.95	25.07	36.62	50.55	86.21	132.13	188.36
22	9.43	16.32	25.65	37.47	51.73	88.22	135.21	192.76
23	9.64	16.69	26.23	38.32	52.90	90.21	138.27	197.12
24	9.85	17.05	26.80	39.14	54.04	92.15	141.24	201.35
25	10.05	17.40	27.35	39.95	55.15	94.05	144.15	205.50
L	Correction Factors For Other Pipe Lengths							
40	1.23	1.22	1.20	1.19	1.16	1.14	1.13	1.11
50	1.14	1.13	1.12	1.11	1.10	1.09	1.08	1.07
60	1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.03
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	0.95	0.95	0.95	0.96	0.96	0.96	0.97	0.97
90	0.90	0.91	0.91	0.92	0.92	0.93	0.94	0.94
100	0.86	0.87	0.88	0.89	0.89	0.90	0.91	0.92

Select barrel for Qp10 = 86cfs.
Outlet Elevation = 730.0

H = 739.5 – (730.0 + 3.5')
42" diameter Pipe
=6.0'
Capacity = 101 cfs. From table 8.07a

Select riser; try 72" riser
Cross-section area of barrel = 138.5 in.2

Cross-section area of riser = 4071 in.2

Ration = 4071/1385 = 2.94 - o.k.

Check head at crest

Q = 3.1LH 3/2

H3/2 = $\frac{86}{3.1\ L}$; L = 18.85

H= 1.3'
Find depth of flow at emergency spillway
Crest for 24' wide spillway. Flow through principal spillway: 86 cfs.
Flow in emergency spillway

= 151-86=65 cfs. H 2/2 = $\frac{65}{3xL=3x24}$ = 0.903

H = 093'

Base of Riser	
Bottom of Pond	736
Top of Permanent Sediment Storage	737.2
Top of Permanent Water Quality Storage	741.2
Top of Temporary Water Quality Storage	741.3
Crest of emergency spillway	742.6
100 – year peak flow elevation	743.5
Top of Bank	744.5

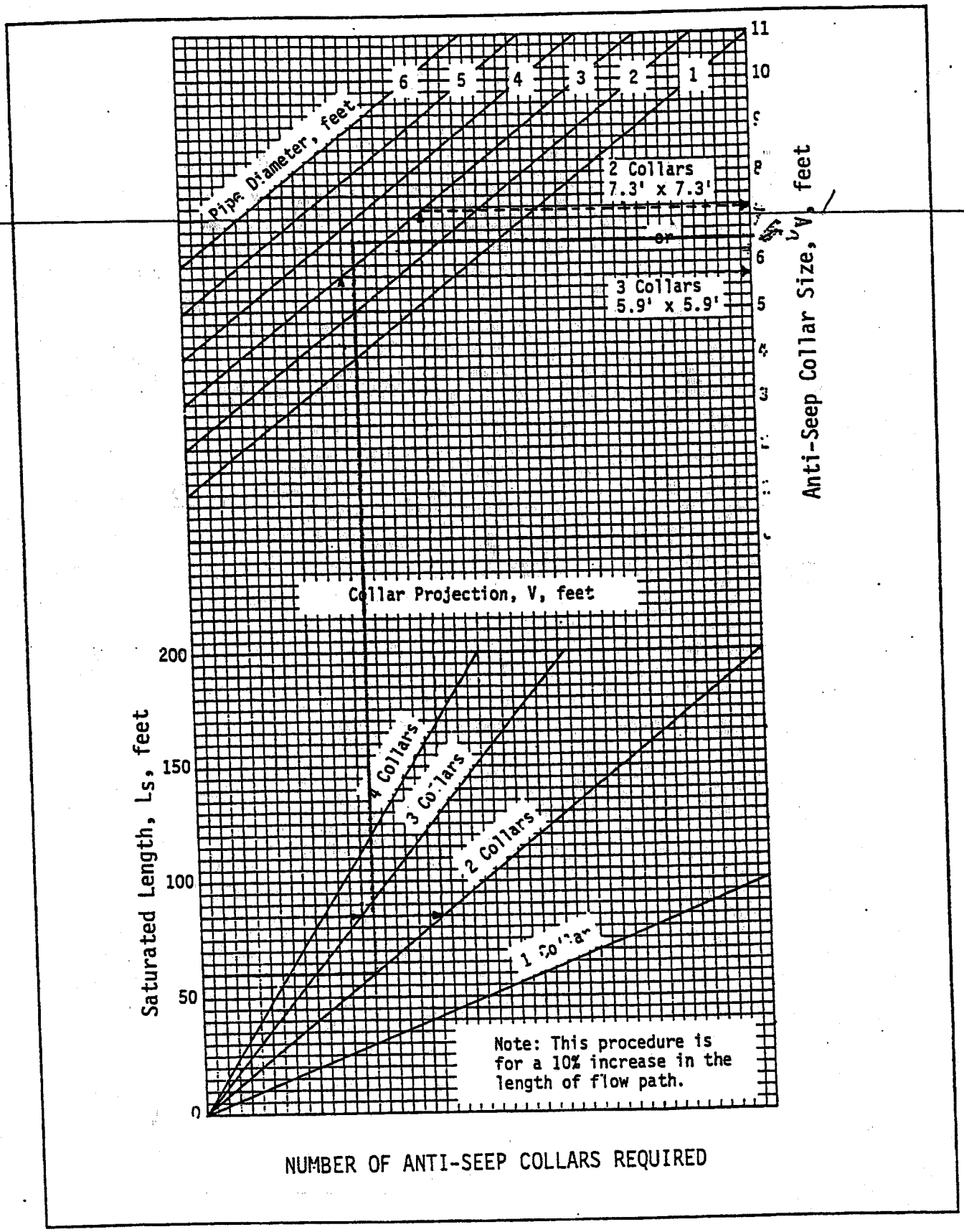
Qpz = 43 cfs.
Qpz = 86 cfs.
Qpz= 107 cfs.
Qpz = 151 cfs.

SB-1 Inlet
Worksheet for Circular Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SB-3 Inlet
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.015000	ft/ft
Diameter	36.00	in
Discharge	25.00	cfs

Results		
Depth	13.7	in
Flow Area	2.46	ft^2
Wetted Perimeter	3.98	ft
Top Width	2.91	ft
Critical Depth	1.61	ft
Percent Full	37.96	
Critical Slope	0.004409	ft/ft
Velocity	10.16	ft/s
Velocity Head	1.60	ft
Specific Energy	2.74	ft
Froude Number	1.95	
Maximum Discharge	87.87	cfs
Full Flow Capacity	81.68	cfs
Full Flow Slope	0.001405	ft/ft
Flow is supercritical.		



Source: USDA-SCS

Plate 3.14-12

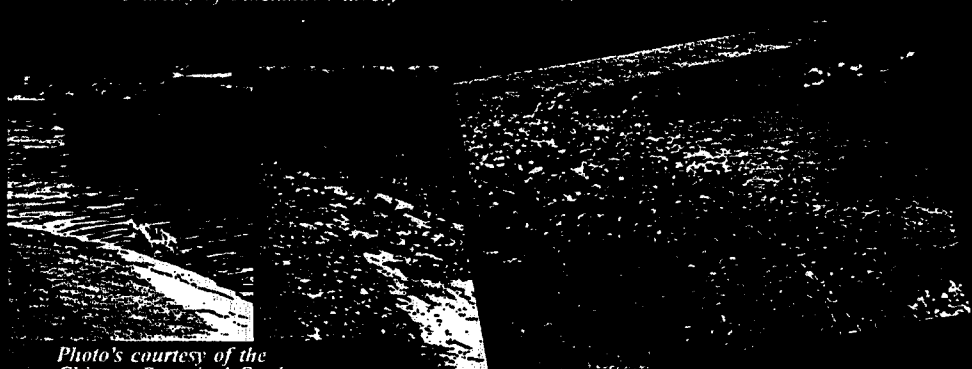
Erosion Control... Nature's Way.

EnTerra® America

Product Guide

- *Agricultural Drainage*
- *Airfields*
- *Bridge Abutments*
- *Channel Liners*
- *Channel Shoulders*
- *Culvert Outfalls*
- *Cuttings and Hillsides*
- *Dams*
- *Detention Ponds*
- *Drought Area Revegetation*
- *Earth Dam Vegetation*
- *Golf Course Wetlands Construction*
- *Grassed Waterways*
- *High Elevation Vegetation and Reclamation*
- *Hiking Trail Development*
- *Interim Erosion Control During Construction*
- *Landfill Reclamation*
- *Landscaping*
- *Logging Reclamation*
- *Mine Reclamation*
- *Natural Lakes*
- *Tidal Marshes*
- *Rail Embankments*
- *Reservoirs*
- *Revegetate Cut and Fill Slopes*
- *Revitalize Polluted River Embankments*
- *River Floodplains*
- *Road Embankments*
- *Ski Slopes*
- *Ski Lift Trades*
- *Slide Reclamation*
- *Slopes Landscaping*
- *Shoreliner*
- *Stream Bank Reclamation*
- *Wildflower Establishment*

Photo's courtesy of Pinelands Nursery



Photo's courtesy of the Chicago Botanical Gardens

Yaquina Bay Lighthouse Newport Oregon
Photo's courtesy Kruegers Erosion Control

JOYCE ENGINEERING, INC

Waste Industry Experts

Job: MRL of HP

Job No.: 602.03 Sheet No. ____ of ____

Calculated by: CK Date: 7/1/07

Checked by: ____ Date: ____

Subject: Esc Scale: ____

Slope drain sizing, cont'd

then

for 6" pipe

$Q_{full} = (1.49/0.22)(0.1963)(0.125)^{2/3}(0.33)^{1/2} = 1.91$ c/o

for 12" pipe

$Q_{full} = (1.49/0.22)(0.7854)(0.25)^{2/3}(0.33)^{1/2} = 12.13$ c/o

for 18" pipe

$Q_{full} = (1.49/0.22)(1.7671)(0.375)^{2/3}(0.33)^{1/2} = 35.75$ c/o

→ orifice inflow limits capacity of pipe

Slope Drain Schedule

Area	Q_{25} (c/o)	Slope Drains
2	10.6	2 x 18"
3	12.5	2 x 18"
4	10.3	2 x 18"
5	10.8	2 x 18"
6	12.4	2 x 18"

See pp. ( ) ( ) for 0.5 ([illegible])

JOYCE ENGINEERING, INC

Waste Industry Experts

Job Tree q High Cnx

Job No. 600.03 Sheet No. ____ of ____

Calculated by CK Date 7/1/02

Checked by ____ Date ____

Subject E+SC Scale ____

Slope Drain Sizing

Check orifice inflow rate

→ use $Q = ca\sqrt{2gh}$ → from Standard Handbook for Engineers, p. 21-28

Check following pipe sizes

pipe diameter	area (ft²)	c
6"	0.1963	0.6
12"	0.7854	0.59
18"	1.7671	0.58

c = coefficient of discharge, taken from or based on Table 21-7, Standard Handbook for Civil Engineers, assuming 1' head above ctr pipe

then for

6" pipe $Q = (0.6)(0.1963)(2*32.2*1)^{1/2}$ = 0.94 cfs

12" pipe $Q = (0.59)(0.7854)(2*32.2*1)^{1/2}$ = 3.72 cfs

18" pipe $Q = (0.58)(1.7671)(2*32.2*1)^{1/2}$ = 8.32 cfs

check inflow vs capacity of pipe using

$Q_{pipe} = (1.49/n)(a)(r_h)^{2/3}S^{1/2}$

from Civil Engineering Reference Manual p. 5-5

use S = 0.33 ~ 34:1V selected

n = 0.22 ~ from App 5A, Civil Engineering Reference Manual, corrugated metal pipe

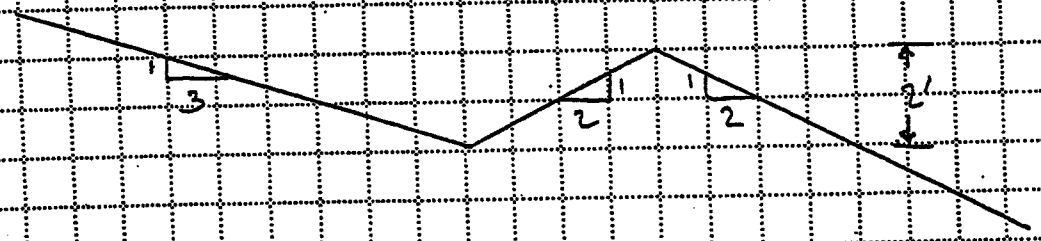
$r_h = 1/4\,d$

JOYCE ENGINEERING, INC

Site Industry Experts

Job MRL @ High Torq
Job No. 600.03 Sheet No. ___ of ___
Calculated by CW Date 7/1/02
Checked by ___ Date ___
Subject Erosion Scale ___

Check diversion dike



Check capacity vs largest area draining to diversion berm
use area = 300x60 = 18000 ft² or = 0.41 acres
C = 0.60
i = 7.2 (max 25 yr storm intensity)

q = ciA = (0.6)(0.41)(7.2) = 1.77 cfs

Check capacity (25 yr storm, high retardance)
max depth flow = 0.27 ft ~ capacity = ok

Check velocity (25 yr storm, earth lining)
velocity = 3.64 ft/sec ~ use temporary lining

Check shear stress in temporary liner
T = ydS
Y = unit weight water = 62.4
d = depth flow = 0.53
S = channel gradient = 0.02

T = (62.4)(0.53)(0.02) = 0.66
~ allowable shear for straw with netting = 1.45

Diversion Berm, 25 Yr Storm, Low Retard
Worksheet for Triangular Channel

Project Description	
Project File	c:\haestad\fmw\mrr high.fm2
Worksheet	Diversion Berm
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.087	
Channel Slope	0.020000	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	2.000000	H : V
Discharge	1.77	cfs

Results		
Depth	0.77	ft
Flow Area	1.46	ft²
Wetted Perimeter	4.13	ft
Top Width	3.83	ft
Critical Depth	0.50	ft
Critical Slope	0.193960	ft/ft
Velocity	1.21	ft/s
Velocity Head	0.02	ft
Specific Energy	0.79	ft
Froude Number	0.34	
Flow is subcritical.		

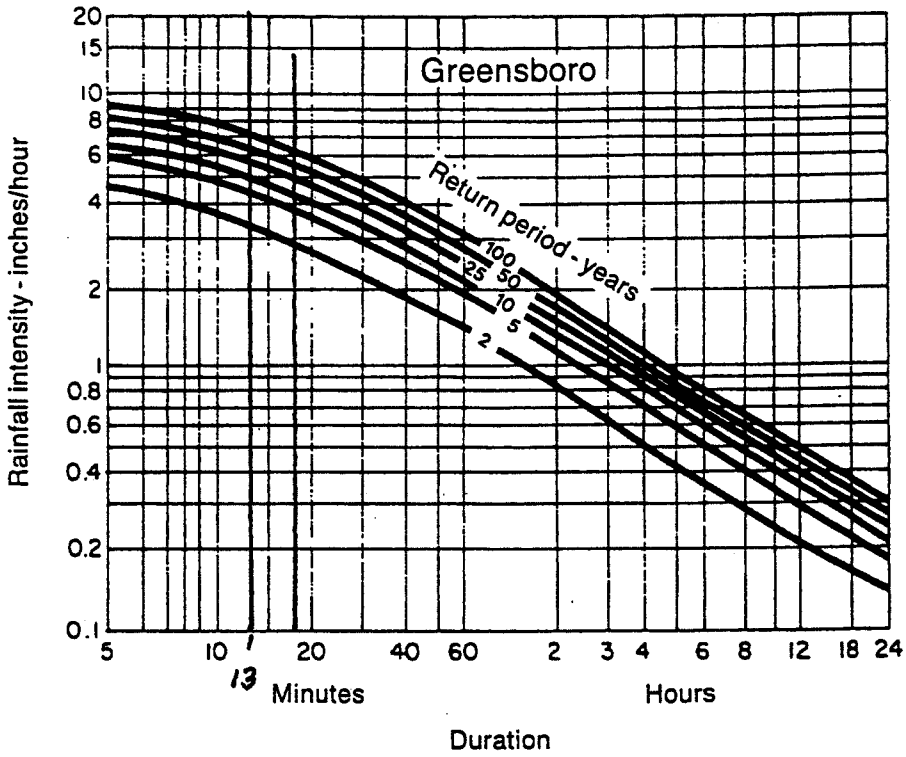


Figure 8.03d Rainfall intensity duration curves—Greensboro.

$I_2 = 3.38$

$I_5 = 4.50$

$I_{10} = 5.00$

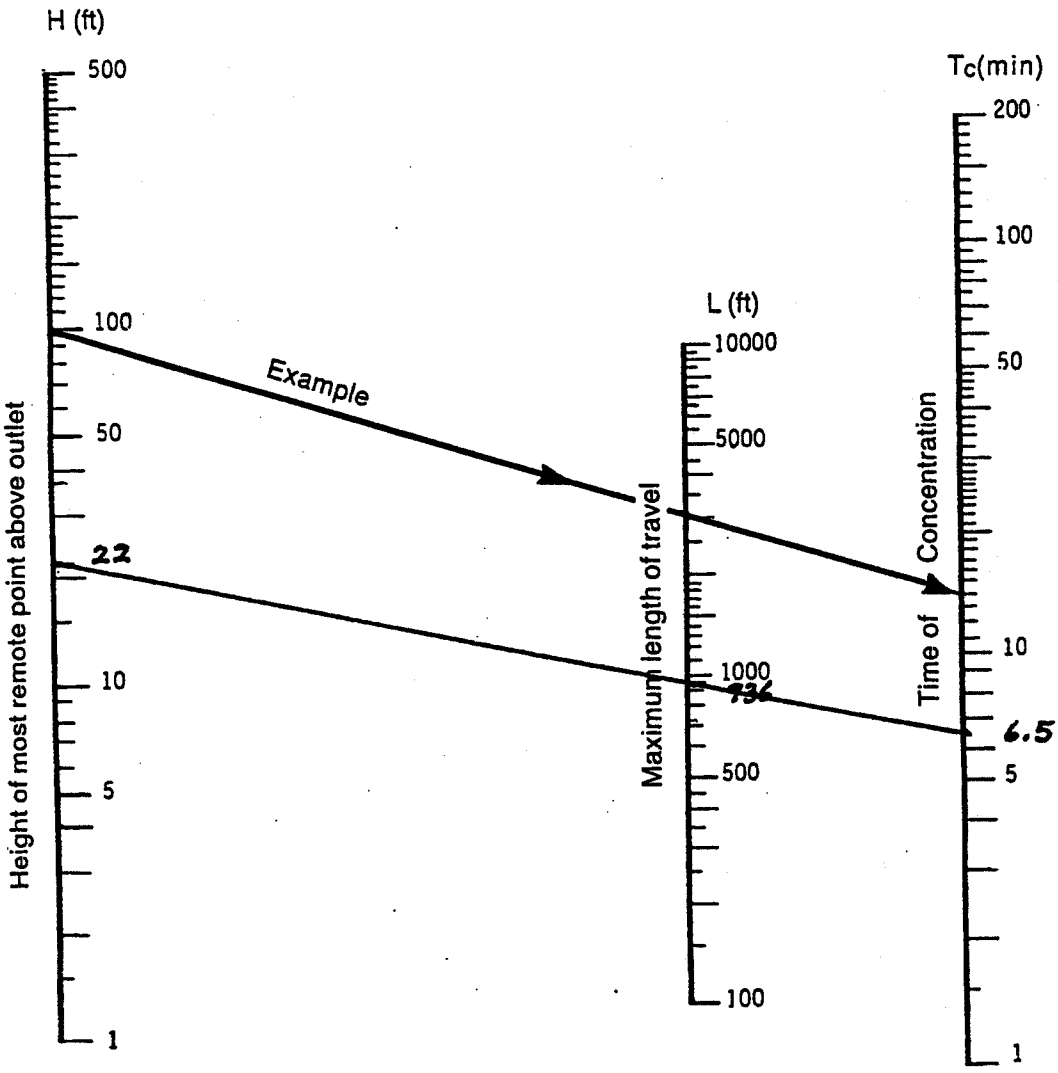
$I_{25} = 5.70$

$I_{50} = 6.20$

$I_{100} = 7.10$

TRAP

SEDIMENT ~~BASIN~~ 2



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. $T_c = 2(6.5\ min.) = 13\ minutes$

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

JOYCE ENGINEERING, INC.

Waste Industry Experts

Pre - 4.90 acre
Post - 7.49

Job
Job No. Sheet No. of
Calculated by JAD Date 6/24/10
Checked by Date
Subject SB-1 Scale

Total drainage area = 7.57 ac.

impervious area = 0.64 * 4.2 = 4.84 ac.

% Impervious = 4.84 / 7.57 = 64 %

- Find Permanent Pool Surface Area to Drainage Area Ratio

Ref. p. 8, High Point Stormwater BMP Design Manual

- for 3' depth, 64% Impervious use,

Ratio = (2.75 - 2.39)(0.4) + 2.39 = 2.53, .0253 X 7.57 ac = .19 ac = 8276 sf.

Increase by 20% to meet Condition B of proposed new permit = 9931 sf (.23 ac)

Calc. composite curve no.

Land Use	Area	CN	
Grassed	2.73 ac	74	(Fmax)
Paved	4.84 ac	98	

Composite CN: $\frac{74(2.73) + 98(4.84)}{7.57} = 89$

19,540 sf. provided = 7.24 (.38 ac sf)

Normal Pool

Temporary water storage is required by the new permanent water quality rule (1" runoff).

Runoff volume R: $\frac{(P - I_a)^2}{(P - I_a) + S}$ $S = \frac{1000}{CN} - 10 = 1.24$

$I_a = 0.2S = 0.2 * 1.24 = 0.25$

R: $\frac{(1 - 0.25)^2}{(1 - 0.25) + 1.24} = 0.35$ in/ac

FV, TR 55
2nd 55
June 1986

FORCE ENGINEERING, INC.

Waste Industry Experts

Job

Job No. _____ Sheet No. ____ of ____

Calculated by _____ Date _____

Checked by _____ Date _____

Subject SB-1 Scale _____

1) Calculate storage

Provide 0.5 ac-in storage for each linear acre draining to the basin.

$V_{req} = 0.5 in \times 7.57 ac = 3.785 ac\text{-}in$

$\frac{3.785 ac\text{-}in}{0.24 ac} = 15.77'' = 1.3'$

Remove water quality storage in the 3' depth

0.24 ac basin.

2) Temporary water quality control required

$= \frac{0.28 inches\ runoff}{12 in/ft} \times 7.57 ac$

$= 0.18 ac\text{-}ft.$

$Depth = \frac{0.18 ac\text{-}ft}{0.38 ac} = 0.47' \approx 0.5'$

provided

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job

Job No. Sheet No. of

Calculated by Date

Checked by Date

Subject SB-1 Scale

$Q_{10} = C \times A$

$t_c = 7.5$ min.

C_{10}: 6 in/hr. $k_{2.5}$: 7 in/hr k_{100} = 8.5 in/hr.

$C = \frac{(21.72)(0.20) + (4.84)(0.76)}{7.57} = 1.65$

Rolling gravity log dump (low vegetation)
Hay, mid-C, average $\Rightarrow$ use $C = 0.20$

$A = 7.57$ ac.

$Q_{10} = (65)(6)(7.57)$ $Q_{25} = (1.65)(7)(7.57)$ $Q_{100} = (1.65)(8.5)(7.57)$

$= 29.5$ cfs. $= 34.4$ cfs. $= 41.8$ cfs.

Slot time (for Q_{25}): $H = 784 - (774 + 2.5) = 7.5$

→ Use 36" pipe, $A = 7.1$ sf = 1018 in²; capacity = 30.5 cfs.

Cross section area w/ max HGL (1/2 full) = 509 in²

1.5 times cross-sectional area w/ bend: Use 48" pipe

Cross sectional area = 1809 in², $\frac{1809}{1018} = 1.78 > 1.5$ O.K.

Hot Q_{25} = 0.8 ft Hot Q_{100} = 1.05'

Check freeboard at Q_{100}

Freeboard = 794.0 − (790.8 + 1.05) = 2.15' > 1.0'

O.K.

ENGINEERING, INC.

Waste Industry Experts

Job No. _____ Sheet No. _____ of _____

Calculated by _____ Date _____

Checked by _____ Date _____

Subject SB-1 Pond 1 Scale _____

Select orifices to provide 5-day drawdown period.

Use 3/4" hole (Cross-sectional area of hole = 0.00306 ft²)

A_o required $= \frac{A_s\sqrt{2h}}{Cd\,20,428}$, $T = 5$ days $= 120$ hours

A_s = surface area at normal pool = 0.38 ac = 16,553 ft²

h = max head above hole = 0.5'

$A_o = \frac{16,553\sqrt{2\times0.5}}{120\times0.6\times20,428}$

$= 0.0159$ ft²

$\frac{0.0159\ ft^2}{0.00306\ ft^2/hole} = 5$ holes

Perforation for Block

Find pounds wt. of soil displaced by 48" pipe.

Wt of soil displaced $= \pi(2)^2(782.8 - 776.0)(62.4)$

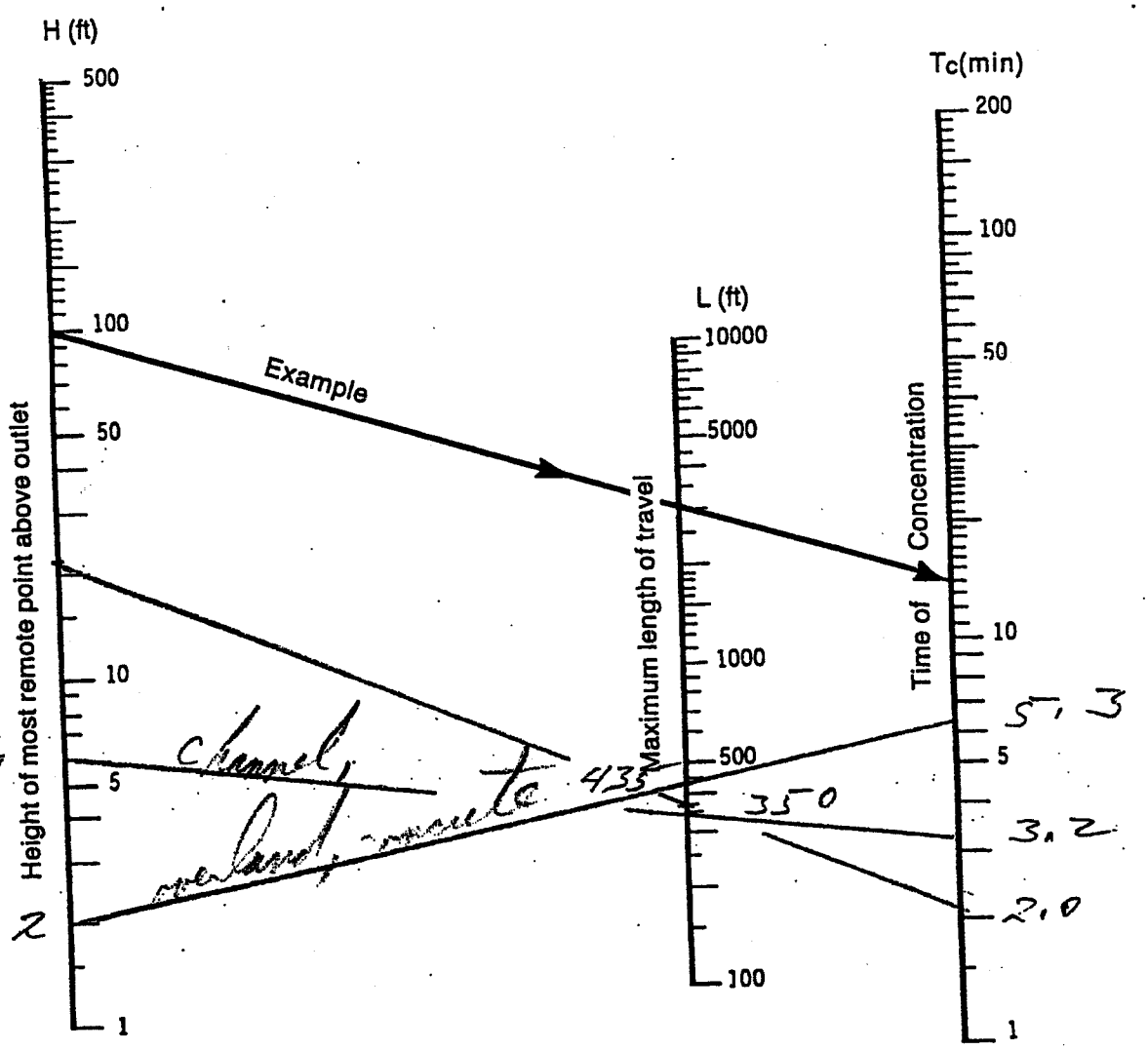
$= 5332$ #

$1.1 \times 5332 = 5865$ #

Volume of block required $= \frac{5865}{(155-62.4)} = 67$ ft³

Use block 18" thick x 7' square

SB-1



$H_2 = 900 - 778 = 22$

$H_1 = 6$

channel, overland, minute T_c 4.33

5.3

3.5.0

3.2

2.0

Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2.

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

A Overland flow: $t_c = 0.4 \times 5.3 = 2.1$ min.

B Channel = 3.2 min.

C Channel = 2.0 $\therefore T_c = 2.1 + 3.2 + 2.0$

SB-1

i_{100} = 8.5 in/hr.
i_{25} = 7 in/hr.
i_{10} = 6 in/hr.
i_2 = 4 in/hr.

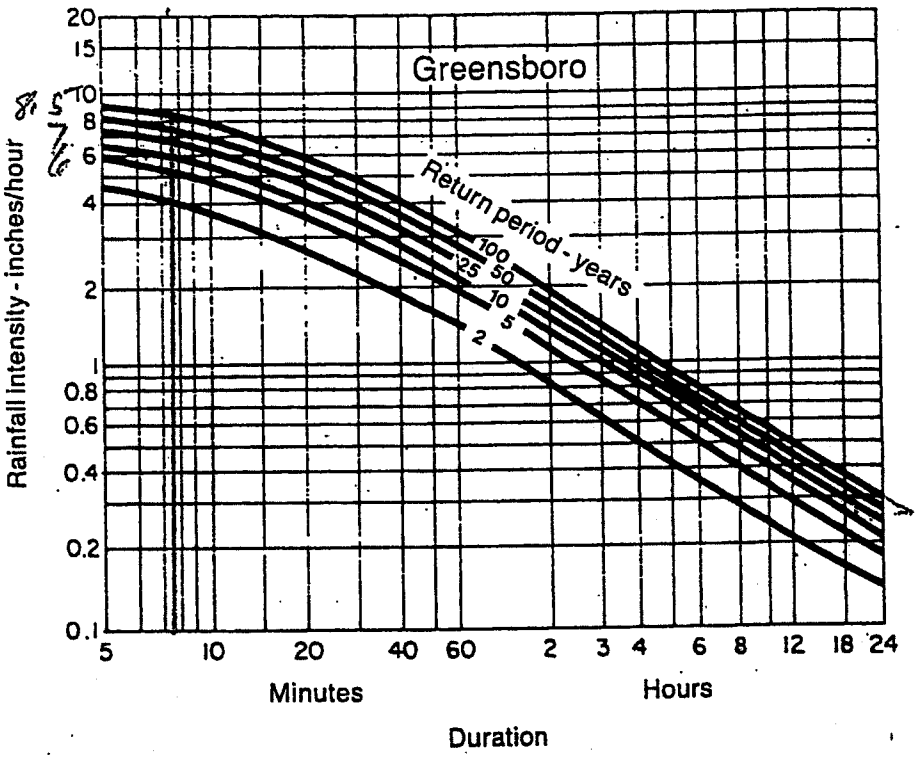


Figure 8.03d Rainfall intensity duration curves—Greensboro.

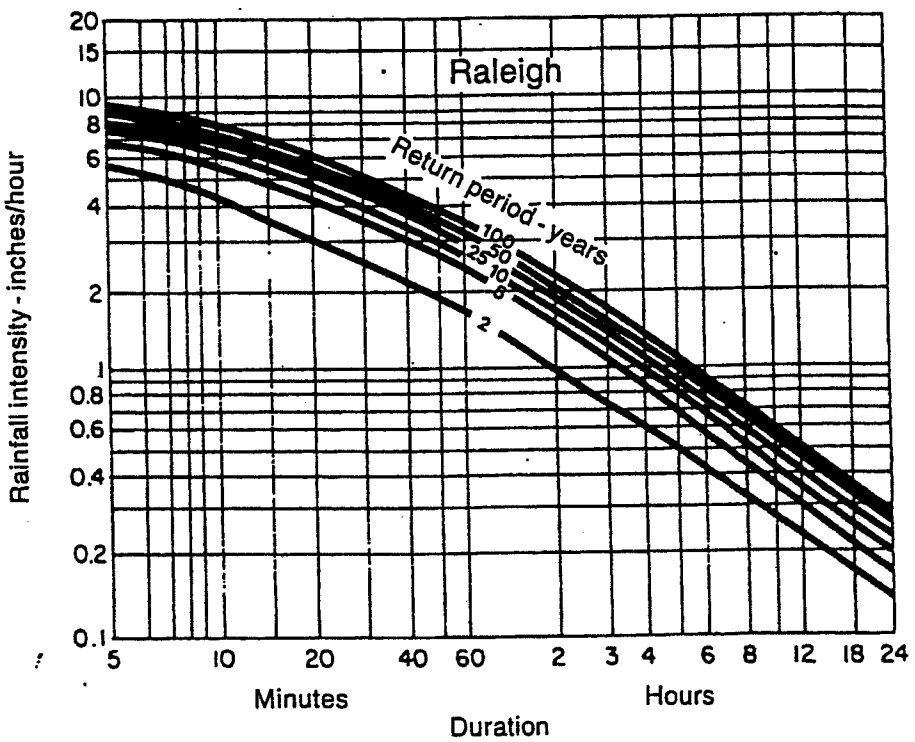


Figure 8.03e Rainfall intensity duration curves—Raleigh.

SB-1

8

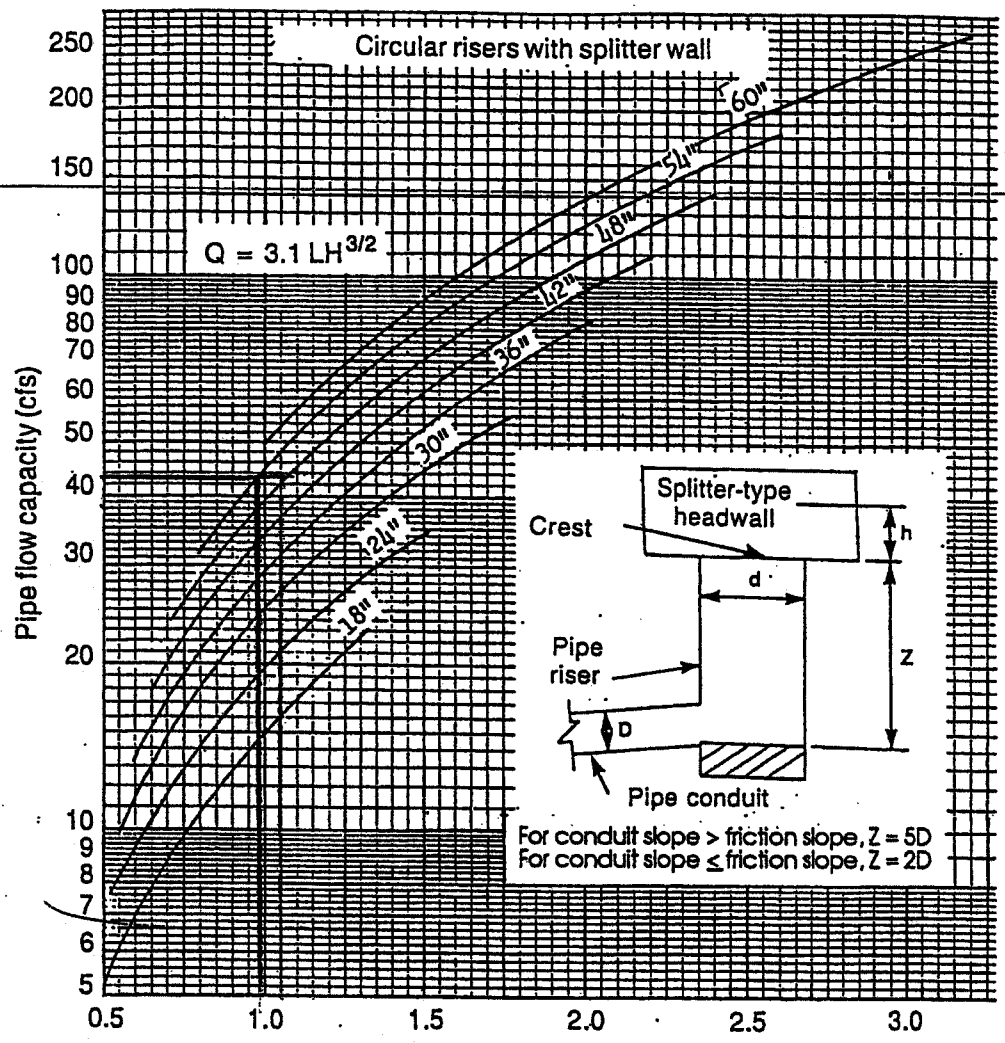
H = 782.8 - (772.0 + Local Losses)

For 36" Lined, H = 7.81'

Table 8.07a
Pipe Flow Chart for Design of Corrugated Metal Outlet Conduit
(Q in cubic ft/sec)

For Corrugated Metal Pipe Inlet $K_e + K_b = 1.0$ and 70 feet of Corrugated Metal Pipe Conduit n = 0.025. Note correction factors for other pipe lengths.

Dia. / H	12"	15"	18"	21"	24"	30"	36"	42"
2	2.84	4.92	7.73	11.30	15.60	26.60	40.77	58.12
3	3.48	6.03	9.47	13.84	19.10	32.58	49.93	71.19
4	4.02	6.96	10.94	15.98	22.06	37.62	57.66	82.20
5	4.49	7.78	12.23	17.87	24.66	42.06	64.46	91.90
6	4.92	8.52	13.40	19.57	27.01	46.07	70.60	100.65
7	5.32	9.21	14.47	21.14	29.19	49.77	76.28	108.75
7 7/8	5.68	9.84	15.47	22.60	31.19	53.19	81.53	116.23
9	6.03	10.44	16.41	23.97	33.09	56.43	86.49	123.30
10	6.36	11.00	17.30	25.26	34.88	59.48	91.16	129.96
11	6.67	11.54	18.14	26.50	36.59	62.39	95.63	136.33
12	6.96	12.05	18.95	27.68	38.21	65.16	99.87	142.37
13	7.25	12.55	19.72	28.81	39.77	67.83	103.96	148.21
14	7.52	13.02	20.47	29.90	41.27	70.39	107.88	153.80
15	7.78	13.48	21.19	30.95	42.72	72.85	111.66	159.18
16	8.04	13.92	21.88	31.96	44.12	75.24	115.32	164.40
17	8.29	14.35	22.55	32.94	45.48	77.55	118.87	169.46
18	8.53	14.77	23.21	33.90	46.80	79.81	122.33	174.39
19	8.76	15.17	23.84	34.83	48.08	81.99	125.67	179.15
20	8.99	15.56	24.46	35.73	49.33	84.12	128.93	183.80
21	9.21	15.95	25.07	36.62	50.55	86.21	132.13	188.36
22	9.43	16.32	25.65	37.47	51.73	88.22	135.21	192.76
23	9.64	16.69	26.23	38.32	52.90	90.21	138.27	197.12
24	9.85	17.05	26.80	39.14	54.04	92.15	141.24	201.35
25	10.05	17.40	27.35	39.95	55.15	94.05	144.15	205.50
L	Correction Factors For Other Pipe Lengths							
40	1.23	1.22	1.20	1.19	1.16	1.14	1.13	1.11
50	1.14	1.13	1.12	1.11	1.10	1.09	1.08	1.07
60	1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.03
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	0.95	0.95	0.95	0.96	0.96	0.96	0.97	0.97
90	0.90	0.91	0.91	0.92	0.92	0.93	0.94	0.94
100	0.86	0.87	0.88	0.89	0.89	0.90	0.91	0.92



H = 1.0 - 1 for 48" Pipe

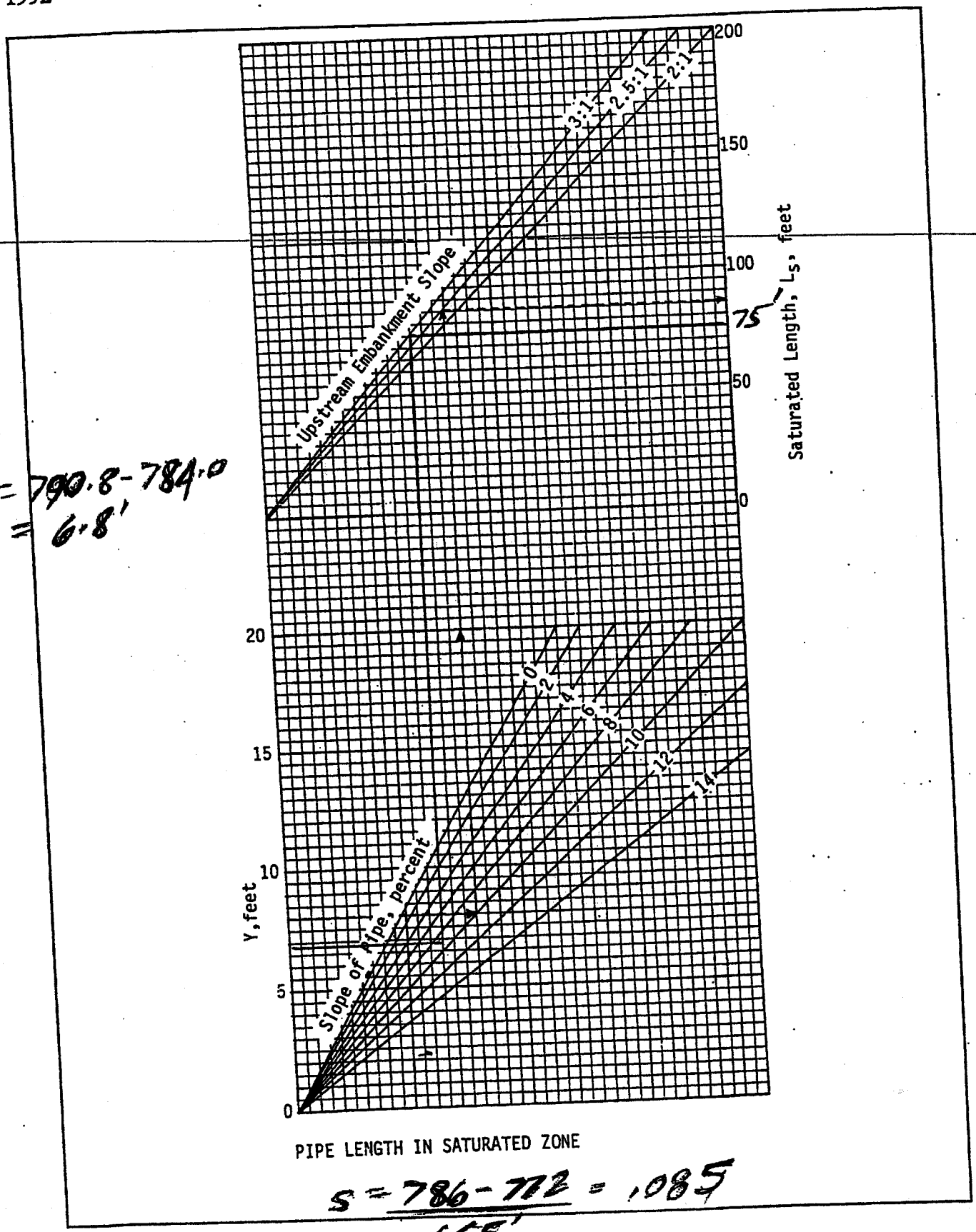
Inlet Proportions	
Pipe Conduit (D) - in	Pipe Riser (d) - in
8-12	18
15	21
18	24
21	30
24	30
30	36
36	48
42	54
48	60

Pipe drop inlet spillway design:

For a given Q and H, refer to Table 8.07a or 8.07b for conduit size. Then determine the riser diameter (d) from the Inlet Proportions Table on this figure. Next, refer to the above curves, using the conduit capacity and riser diameter, and find the head (h) required above the crest of the riser. The height of the riser should not be less than 5D - h, except as noted in the above sketch.

Example - Given: CMP; Q = 20 cfs; H = 14 ft, h max. 1.0 ft; L = 70 ft. From Table 8.07a find conduit size (D) = 18 inches. From Inlet Proportions Table, riser size = 24 inches. Head (h) required for Q = 20 and d = 24 is 1.0 ft.

Figure 8.07b Design chart for riser outlet.



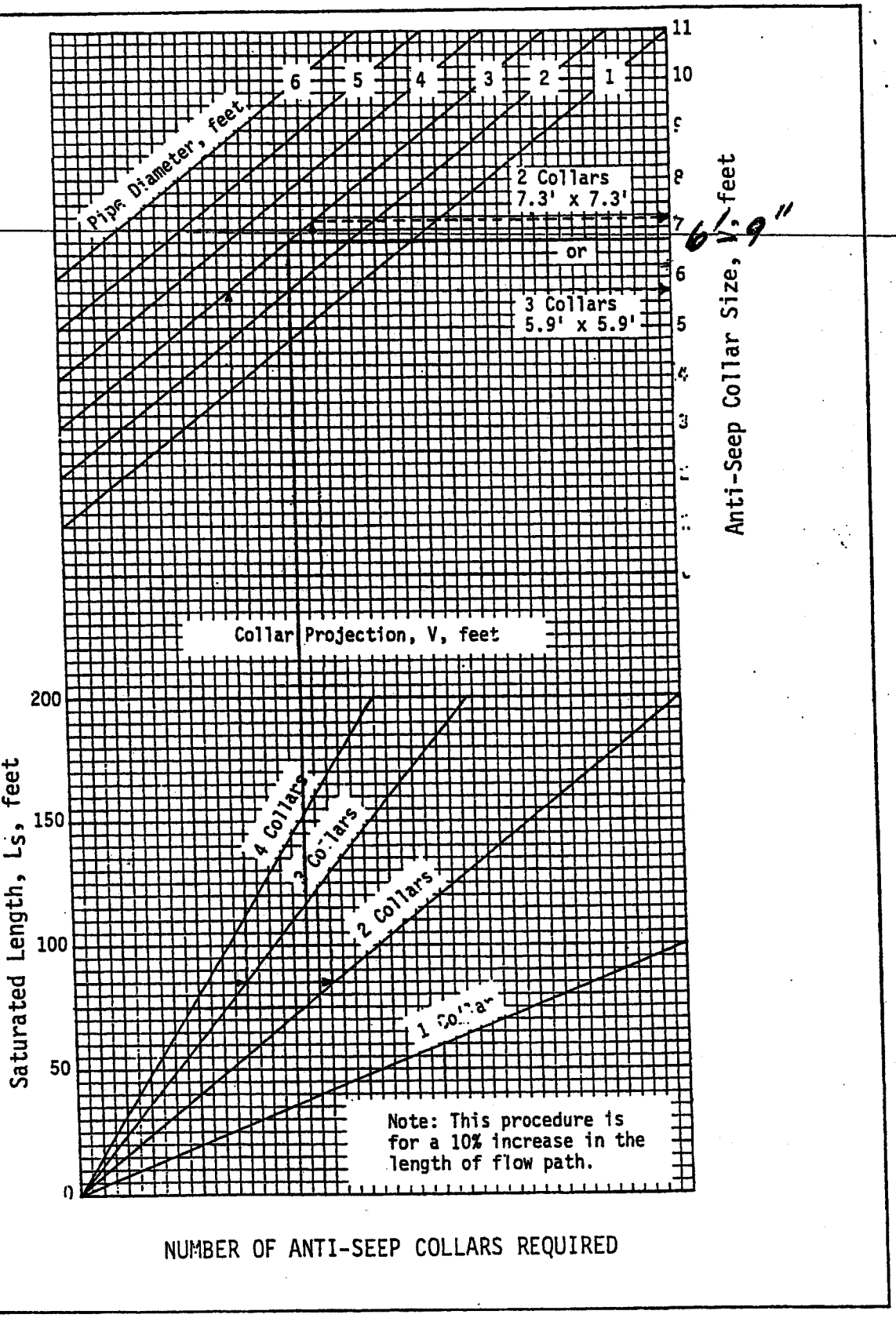
Y = 790.8 - 784.0
= 6.8'

S = 786 - 772 / 165' = .085

Source: USDA-SCS

Plate 3.14-11

SB-1



6', 9"

Source: USDA-SCS

Plate 3.14-12

30" RCP CULVERT: SCC-8 TO SB-1
Worksheet for Circular Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrr-hp-s.fm2
Worksheet	MRR-HP - 24" PIPE TO SB#1 - SDY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Diameter	30.00	in

Results		
Depth	2.50	ft
Discharge	58.00	cfs
Flow Area	4.91	ft²
Wetted Perimeter	7.85	ft
Top Width	0.00	ft
Critical Depth	2.38	ft
Percent Full	100.00	
Critical Slope	0.017335	ft/ft
Velocity	11.82	ft/s
Velocity Head	2.17	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	62.40	cfs
Full Flow Capacity	58.00	cfs
Full Flow Slope	0.020000	ft/ft

SCC-1
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.036700	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	9.52	cfs

Results		
Depth	0.36	ft
Flow Area	2.22	ft^2
Wetted Perimeter	7.30	ft
Top Width	7.19	ft
Critical Depth	0.44	ft
Critical Slope	0.018827	ft/ft
Velocity	4.29	ft/s
Velocity Head	0.29	ft
Specific Energy	0.65	ft
Froude Number	1.36	
Flow is supercritical.		

SCC-2
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-2
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.021300	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	14.16	cfs

Results		
Depth	0.53	ft
Flow Area	3.50	ft^2
Wetted Perimeter	8.36	ft
Top Width	8.19	ft
Critical Depth	0.56	ft
Critical Slope	0.017652	ft/ft
Velocity	4.05	ft/s
Velocity Head	0.25	ft
Specific Energy	0.79	ft
Froude Number	1.09	
Flow is supercritical.		

SCC-3
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-3
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.041300	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	3.92	cfs

Results		
Depth	0.21	ft
Flow Area	1.19	ft^2
Wetted Perimeter	6.33	ft
Top Width	6.27	ft
Critical Depth	0.25	ft
Critical Slope	0.021962	ft/ft
Velocity	3.30	ft/s
Velocity Head	0.17	ft
Specific Energy	0.38	ft
Froude Number	1.34	
Flow is supercritical.		

SCC-4
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-4
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.018100	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	15.23	cfs

Results		
Depth	0.58	ft
Flow Area	3.89	ft^2
Wetted Perimeter	8.66	ft
Top Width	8.47	ft
Critical Depth	0.58	ft
Critical Slope	0.017449	ft/ft
Velocity	3.91	ft/s
Velocity Head	0.24	ft
Specific Energy	0.82	ft
Froude Number	1.02	
Flow is supercritical.		

SCC-5
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-5
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.035000	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	22.98	cfs

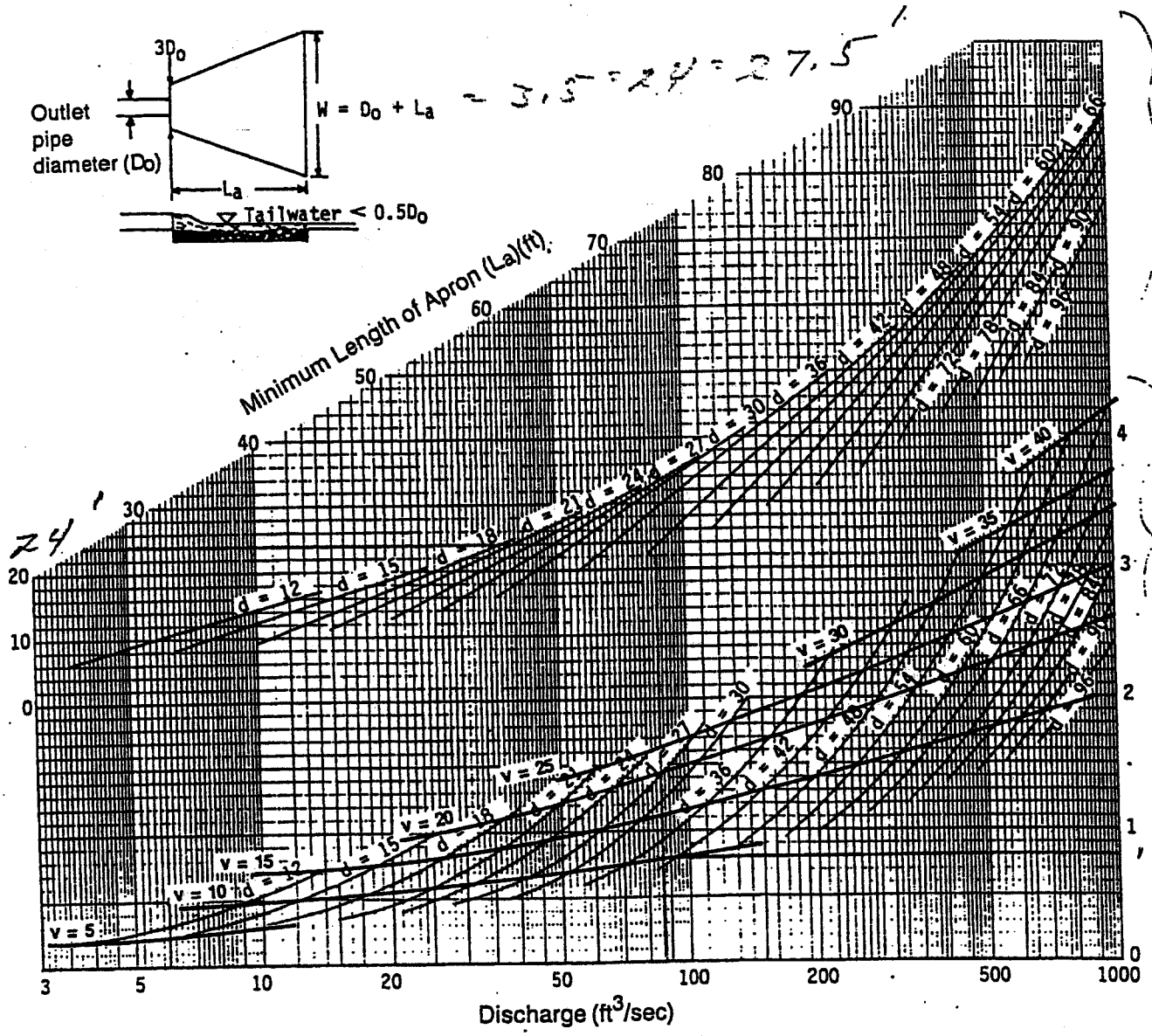
Results		
Depth	0.60	ft
Flow Area	4.12	ft^2
Wetted Perimeter	8.82	ft
Top Width	8.63	ft
Critical Depth	0.74	ft
Critical Slope	0.016376	ft/ft
Velocity	5.58	ft/s
Velocity Head	0.48	ft
Specific Energy	1.09	ft
Froude Number	1.42	
Flow is supercritical.		

SCC-6
Worksheet for Trapezoidal Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SCC-6
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.047200	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft
Discharge	26.10	cfs

Results		
Depth	0.60	ft
Flow Area	4.06	ft^2
Wetted Perimeter	8.78	ft
Top Width	8.58	ft
Critical Depth	0.80	ft
Critical Slope	0.016064	ft/ft
Velocity	6.43	ft/s
Velocity Head	0.64	ft
Specific Energy	1.24	ft
Froude Number	1.65	
Flow is supercritical.		

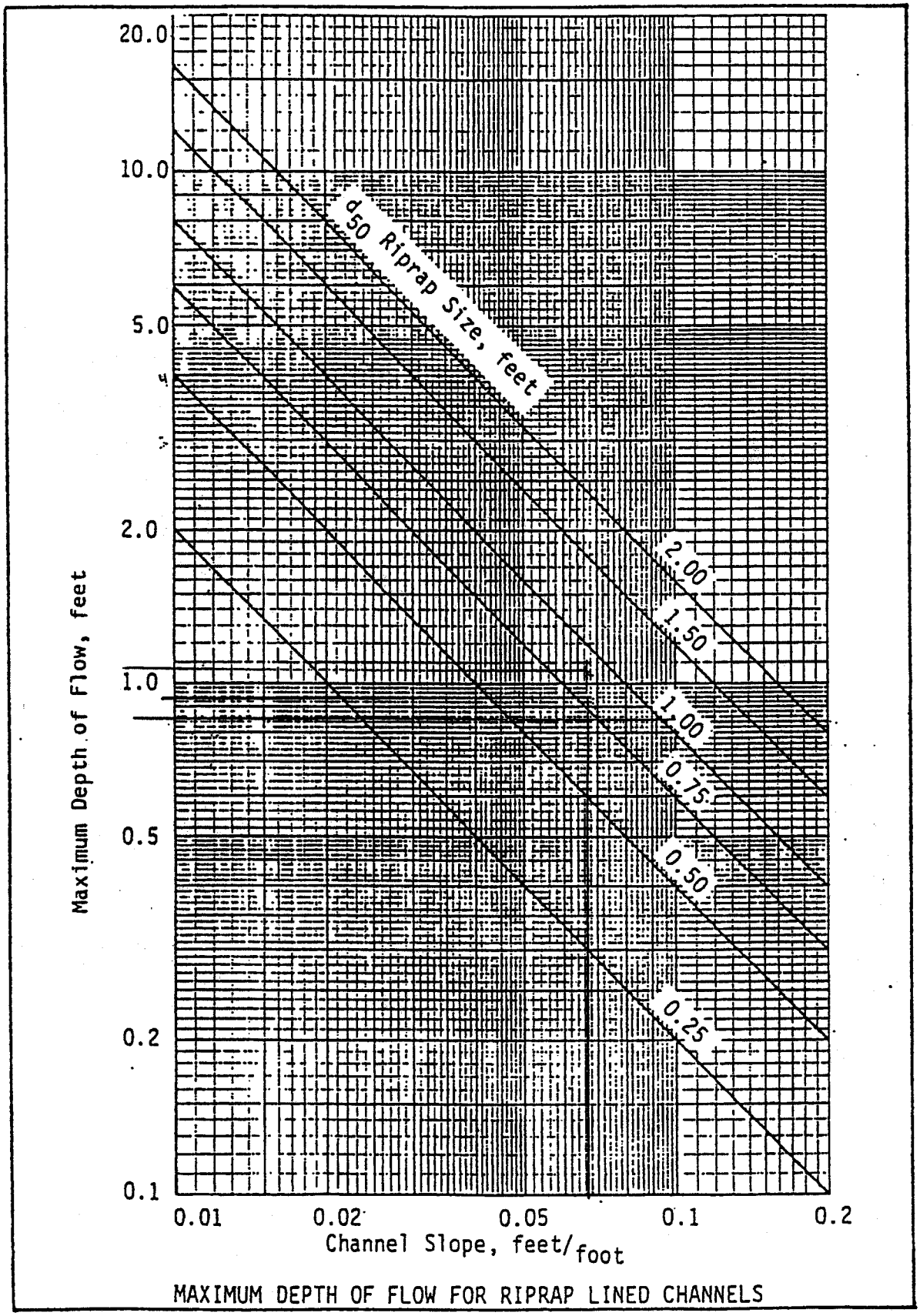


Curves may not be extrapolated.

Figure 8.06a Design of outlet protection protection from a round pipe flowing full, minimum tailwater condition (T_w < 0.5 diameter).

SIZING OF RIPRAP

1992



MAXIMUM DEPTH OF FLOW FOR RIPRAP LINED CHANNELS

Source: VDOT Drainage Manual

CHANNEL 5 $D_{50} = 0.75'(9")$

CHANNEL 6 $D_{50} = 1.00'(12")$

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job MRR - HP

Job No. 600.06 Sheet No. 1 of

Calculated by MDE Date 1/22/03

Checked by Date

Subject Disposal Area Drainage Scale

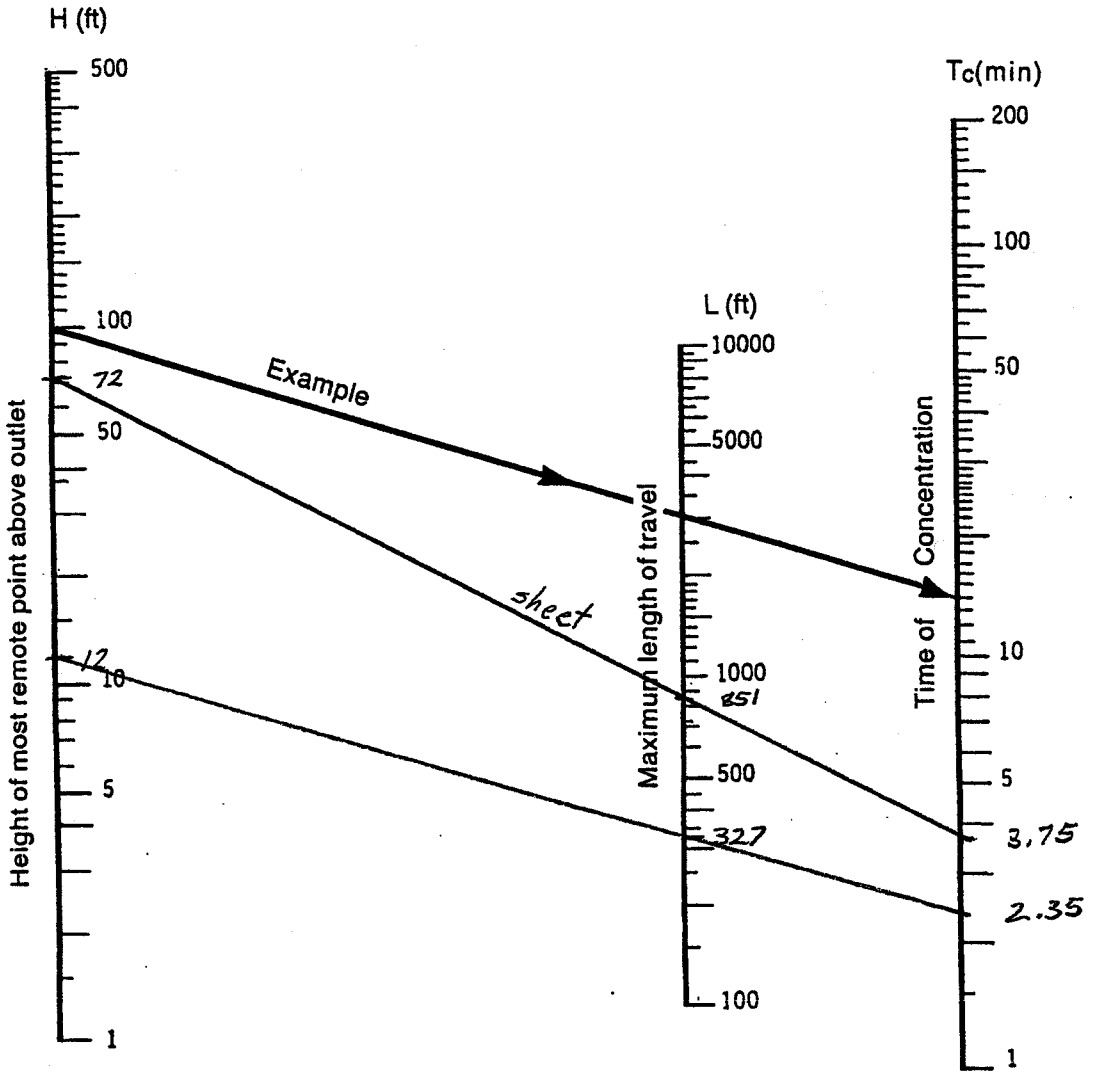
CHANNEL	A AREA (acres)	C	I (25yr) INTENSITY	SLOPE	Q (cfs)	Tc Time of Concentration
SCC-1	2.60	.60	6.1	0.0367	9.52	10.35
SCC-2	1.27	.60	6.1	0.0213	4.65	11.00
SCC-3	1.07	.60	6.1	0.0413	3.92	10.20
SCC-4	3.09	.60	6.1	0.0181	11.31	7.85
SCC-5	2.12	.60	6.1	0.0350	7.76	11.25
SCC-6	3.26	.60	6.1	0.0472	11.93	10.35

Channel	Contributing Drainage Area	Area (Acres)	Q	V
1	1	2.60	9.52	4.29
2	1,2	3.87	14.16	4.05
3	3	1.07	3.92	3.30
4	3,4	4.16	15.23	3.91
5	3,4,5	6.28	22.98	5.58
6	1,2,6	7.13	26.10	6.43

- All channels are Trapezoidal with 3H:1V – 2' deep, 5' base (cross-sectional area = 22 ft²)
- R = 1.25
- n = 0.030

SCC-1 & Area

327 ft, slope 3.67%



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. → 3.75 min X 2 = 7.50 min. sheet
3.35 ditch
10.85 min

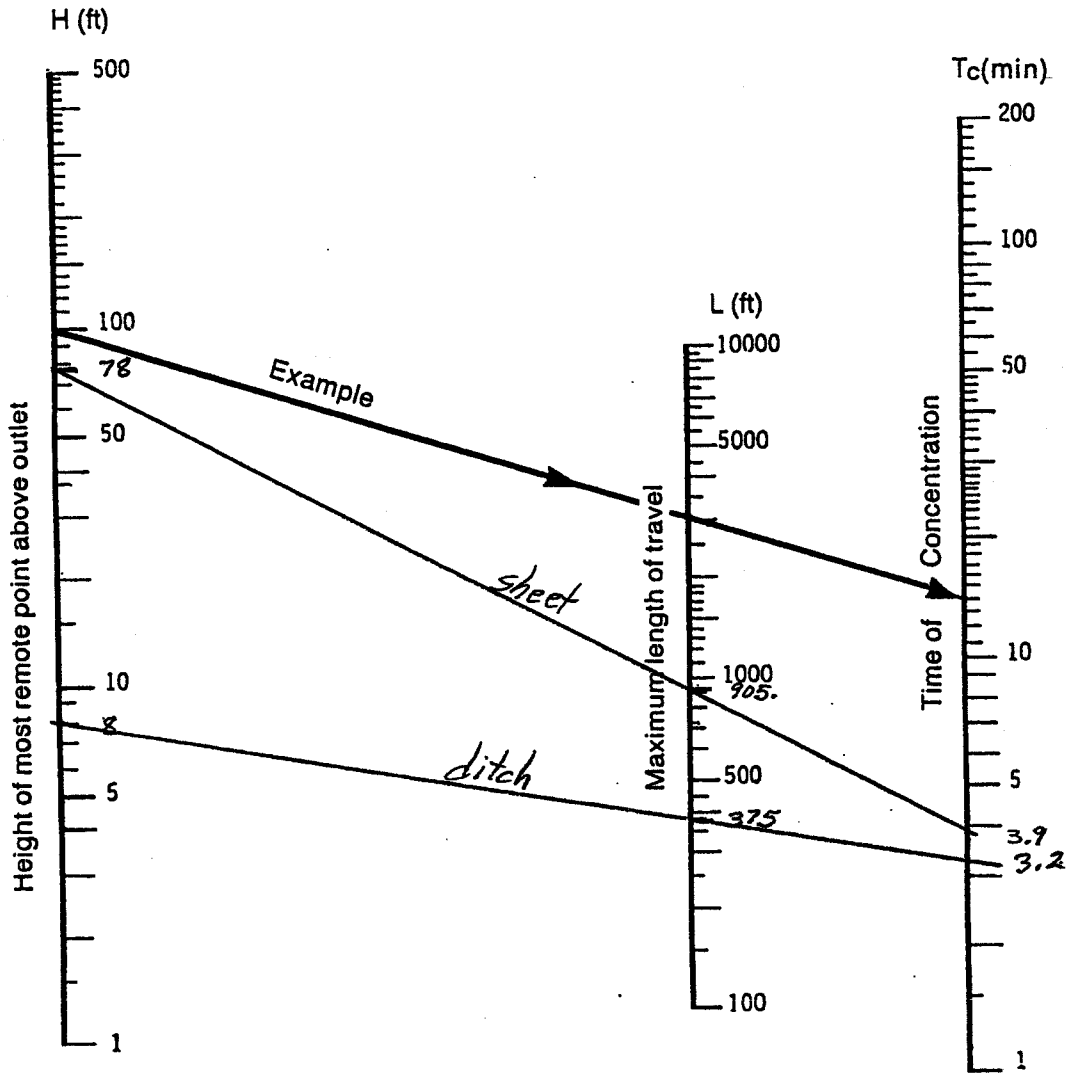
For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

SCC-2 Area

375 ft, slope 2.13%



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. → 3.9 x 2 = 7.8 min. sheet

3.2 min. ditch

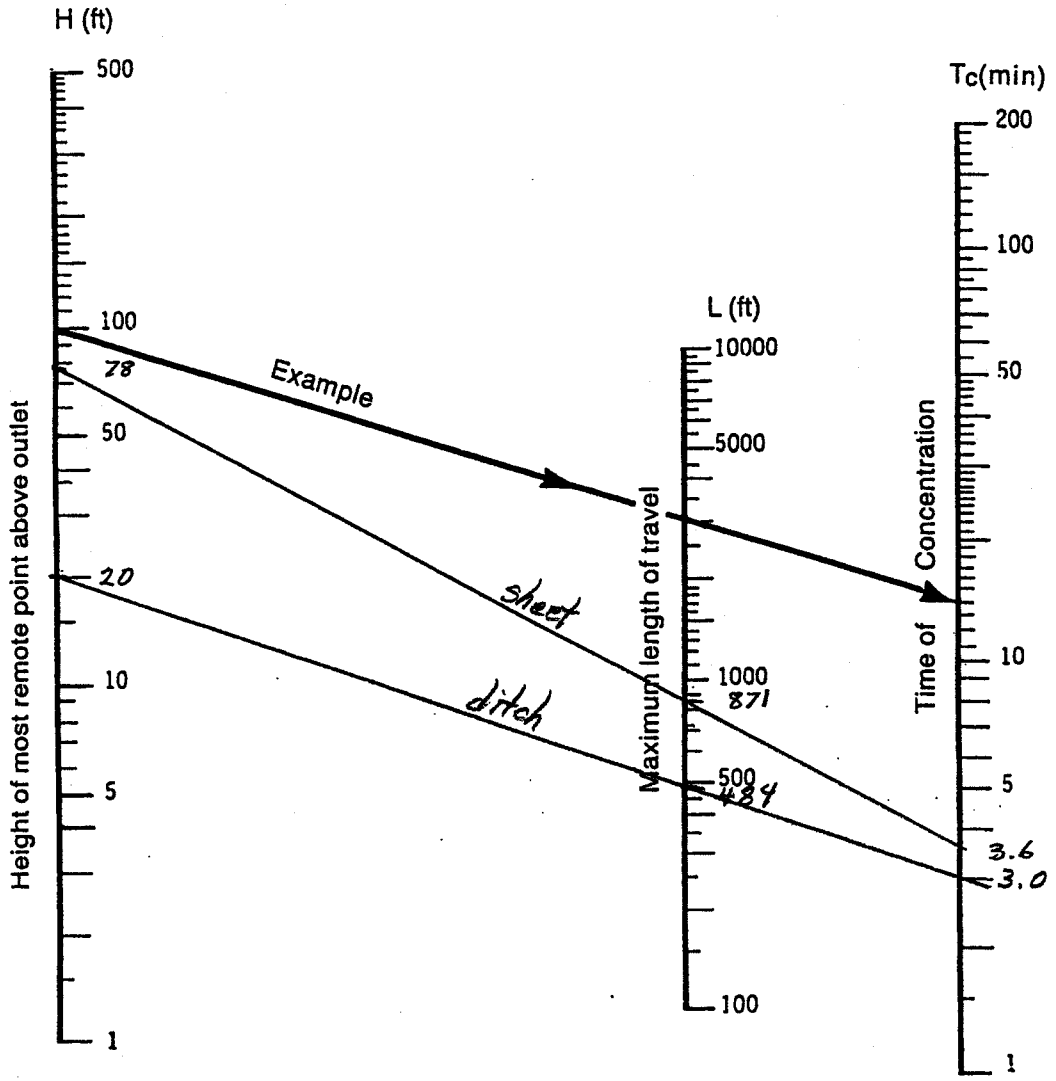
11.0 min

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

SCC-3 Area
484 ft, slope 4.13%



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. → 3.6 min. X 2 = 7.2 min sheet

3.0 min. ditch

10.2 min

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

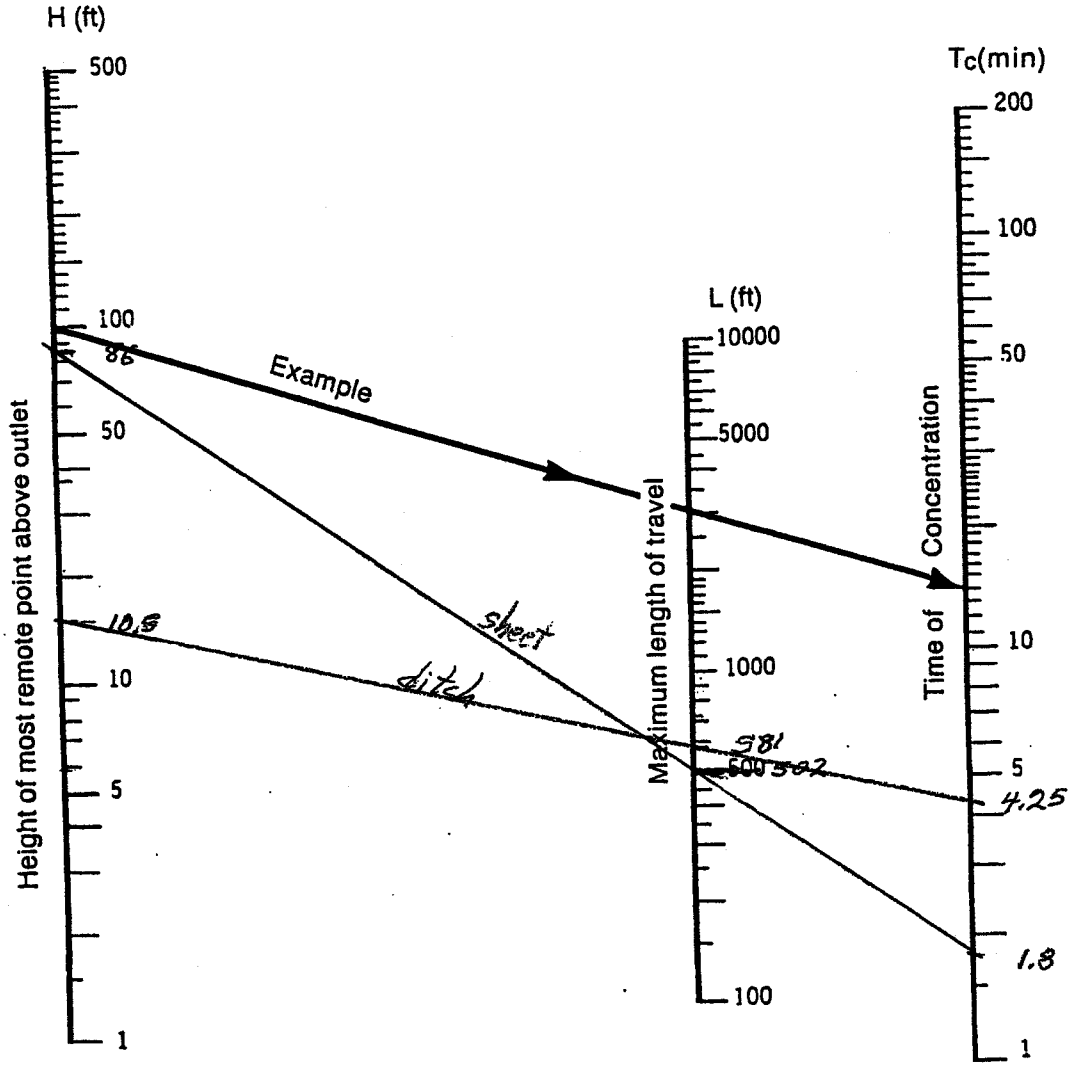
For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

8

SCC-4 Area

581 ft, Slope 1.81%



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. ⇒ 1.8 min X 2 = 3.6 min. sh

4.25 min dit

7.85 min

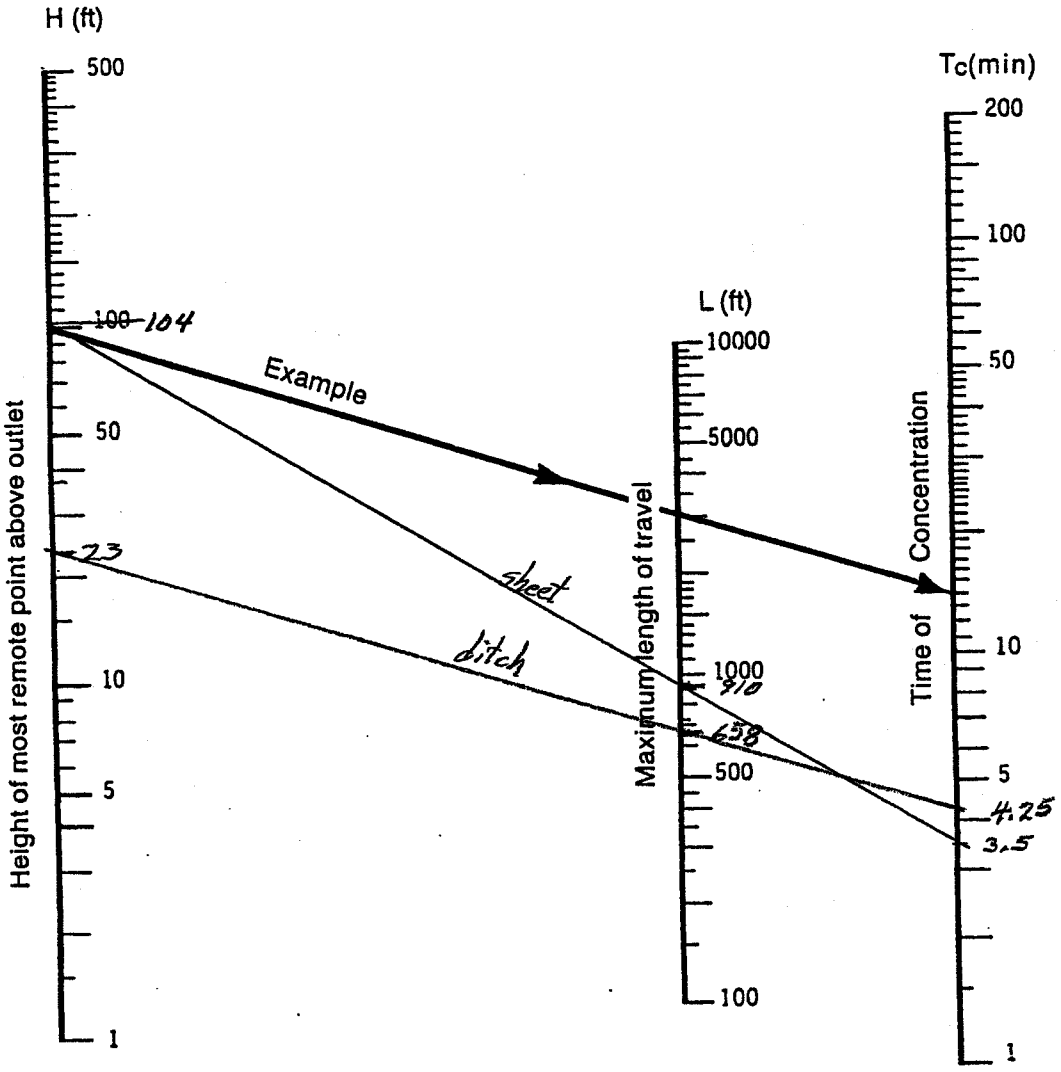
For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

SCC-5 Area

658 ft, slope 3.50%



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. → 3.5 min X 2 = 7.0 min sheet

4.25 min ditch

11.25 min

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

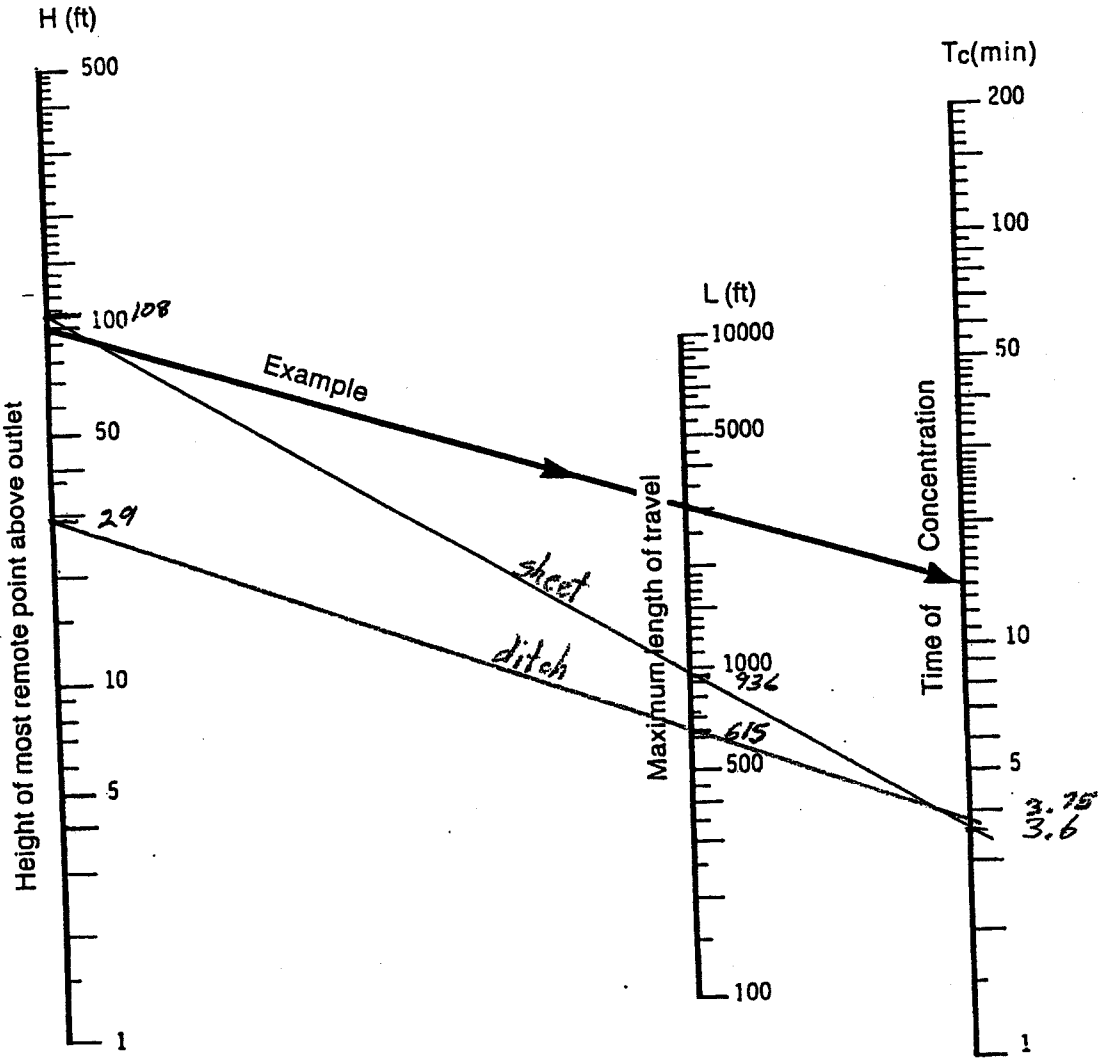
For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

8

SCC-6 Area

625 ft, slope 4.72%



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. → 3.6 x 2 = 7.2 min. sheet

3.75 min. ditch

10.95

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job

Job No. Sheet No. 1 of

Calculated by QLL Date 4/26/02

Checked by Date

Subject SK-3 Scale

Total Drainage Area = 26.7 acres

% Built upon area = 100%

Calc. per-Complete area required for 100% built upon area, 4" depth.

N.C.D.E.P. 8, High Pert Stormtech BMP Design Manual

Ratio = 3.25 when using 4" depth & 100% built upon

26.7 ac. X 0.0325 = 0.868 ac.

Increase by 20% to meet Condition B of Section C

Use Limit ⇒ 1.2 X 0.868 ac = 1.04 ac.

Calc. Composite Curve No.

		CN
Grass	26.2 ac	74
Grass (33.5 X 50'/ac X 12' = 20,100 ft.² :	0.5 ac	89

$$\text{Composite CN} = \frac{(74)(26.2) + 89(0.5)}{26.7} = 74.3$$

$$\text{Runoff-Curve } Q = \frac{(P - I_a)^2}{(P - I_a) + S}, \quad S = \frac{1000}{CN} - 10 = 3.46$$

$$I_a = 0.2S = 0.2 \times 3.46 = 0.69$$

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job _____

Job No. _____ Sheet No. 2 of _____

Calculated by _____ Date _____

Checked by _____ Date _____

Subject CL-3 Scale _____

$$Q = \frac{(I-0.69)^2}{(I-0.69)+3.46} = 0.025''$$

Total volume of runoff = $\frac{0.025'' \times 26.7 \text{ ac.}}{12 \text{ in/ft.}}$

$= 0.056 \text{ ac-ft.}$

Min. in the volume to be provided by temporary water quality storage at normal pool elev.

Depth = $\frac{0.056 \text{ ac-ft.}}{1.04 \text{ ac.}} = 0.054' \text{ say } 0.06'$, use 0.1'

Calc. required storage requirement

Provide 0.5 ac-in storage for each disturbed acre draining to the basin. Disturbed area = 26.7 ac

Used = 0.5 in × 26.7 ac = 13.35 ac-in.

$\frac{13.35 \text{ ac-in}}{0.9 \text{ ac.}} = 14.83'' = 1.2'$

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job

Job No. Sheet No. 3 of

Calculated by Date

Checked by Date

Subject SB-3 Scale

Base of Pond	
Bottom of Pond	724.0
Top of Permanent Sediment Storage	725.2
Top of Permanent Water Quality Storage	729.2
Top of Temporary Water Quality Storage	729.3
Crest of emergency spillway	730.6
100-year peak flow elev.	731.5
Top of Berm	732.5

Q_{p_2} = 43 cfs

$Q_{p_{10}}$ = 86 cfs

$Q_{p_{25}}$ = 107 cfs.

$Q_{p_{100}}$ = 151 cfs.

Select travel for Q_{10} = 8.6 cfs.

Outlet E = Inv = 720.0

H = 729.5 − (720.0 + 3.5/2) = 4.25' diameter pipe

= 6.0'

Capacity = 10.1 cfs. from Table 8.07a

Select riser; try 12" riser

Cross-sectional area of travel = 138.5 in.²

Cross-sectional area of riser = 40.71 in.²

Ratio = 40.71/138.5 = 29% - OK.

Check travel at exit

$Q = 3.1LH^{3/2}$

$H^{3/2} = \frac{8.6}{3.1L}$; L = 18.85

H = 1.3'

Find depth of flow at emergency spillway exit for 24' wide spillway. Flow through principal spillway: 8.6 cfs. Flow in emergency spillway = 151 - 86 = 65 cfs.

$H^{3/2} = \frac{65}{3XL} = \frac{65}{3X24} = 0.903$

H = 0.93'

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job

Job No. Sheet No. 5 of

Calculated by Date

Checked by Date

Subject SA-3 Scale

Select type B anode 5-day duration period.
Use 3½" holes. Cross-sectional area of hole = 0.00308 ft.²

$A_{required} = \frac{A_s\sqrt{2h}}{T_d 20,428}$, Let T = 5 days
= 120 hours

A_s = surface area = 104 sf = 45,702 ft.²

h = max. soil column hole = 0.1 ft.

$$A_o = \frac{45702\sqrt{2X0.1}}{120 \times 0.6 \times 20,428}$$

= 0.0139 ft.²

$\frac{0.0139 \text{ ft}^2 \text{ required}}{0.00308 \text{ ft}^2/\text{hole}}$ = 5 holes needed.

Backfill Lock

Find largest wt. of soil displaced by 72" max

Wt. of soil displaced = $\pi(3)^2(229.3 - 227.0)(62.4)$
= 12880 #

1.1 X 12880 = 14168 #

Volume of backfill required = $\left(\frac{2116.5}{154 - 62.4}\right)$ = 16 cf

Use steel 2' thick X 9' plate.

SB-3

Table 8.07a
Pipe Flow Chart for Design of Corrugated Metal Outlet Conduit
(Q in cubic ft/sec)

For Corrugated Metal Pipe Inlet $K_e + K_b = 1.0$ and 70 feet of Corrugated Metal Pipe Conduit n = 0.025. Note correction factors for other pipe lengths.

Dia. / H	12"	15"	18"	21"	24"	30"	36"	42"
2	2.84	4.92	7.73	11.30	15.60	26.60	40.77	58.12
3	3.48	6.03	9.47	13.84	19.10	32.58	49.93	71.19
4	4.02	6.96	10.94	15.98	22.06	37.62	57.66	82.20
5	4.49	7.78	12.23	17.87	24.66	42.06	64.46	91.90
6	4.92	8.52	13.40	19.57	27.01	46.07	70.60	100.65
7	5.32	9.21	14.47	21.14	29.19	49.77	76.28	108.75
8	5.68	9.84	15.47	22.60	31.19	53.19	81.53	116.23
9	6.03	10.44	16.41	23.97	33.09	56.43	86.49	123.30
10	6.36	11.00	17.30	25.26	34.88	59.48	91.16	129.96
11	6.67	11.54	18.14	26.50	36.59	62.39	95.63	136.33
12	6.96	12.05	18.95	27.68	38.21	65.16	99.87	142.37
13	7.25	12.55	19.72	28.81	39.77	67.83	103.96	148.21
14	7.52	13.02	20.47	29.90	41.27	70.39	107.88	153.80
15	7.78	13.48	21.19	30.95	42.72	72.85	111.66	159.18
16	8.04	13.92	21.88	31.96	44.12	75.24	115.32	164.40
17	8.29	14.35	22.55	32.94	45.48	77.55	118.87	169.46
18	8.53	14.77	23.21	33.90	46.80	79.81	122.33	174.39
19	8.76	15.17	23.84	34.83	48.08	81.99	125.67	179.15
20	8.99	15.56	24.46	35.73	49.33	84.12	128.93	183.80
21	9.21	15.95	25.07	36.62	50.55	86.21	132.13	188.36
22	9.43	16.32	25.65	37.47	51.73	88.22	135.21	192.76
23	9.64	16.69	26.23	38.32	52.90	90.21	138.27	197.12
24	9.85	17.05	26.80	39.14	54.04	92.15	141.24	201.35
25	10.05	17.40	27.35	39.95	55.15	94.05	144.15	205.50
L	Correction Factors For Other Pipe Lengths							
40	1.23	1.22	1.20	1.19	1.16	1.14	1.13	1.11
50	1.14	1.13	1.12	1.11	1.10	1.09	1.08	1.07
60	1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.03
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	0.95	0.95	0.95	0.96	0.96	0.96	0.97	0.97
90	0.90	0.91	0.91	0.92	0.92	0.93	0.94	0.94
100	0.86	0.87	0.88	0.89	0.89	0.90	0.91	0.92

Select barrel for Qp10 = 86cfs.
Outlet Elevation = 730.0

H = 739.5 – (730.0 + 3.5')
42" diameter Pipe
=6.0'
Capacity = 101 cfs. From table 8.07a

Select riser; try 72" riser
Cross-section area of barrel = 138.5 in.2

Cross-section area of riser = 4071 in.2

Ration = 4071/1385 = 2.94 - o.k.

Check head at crest

Q = 3.1LH 3/2

H3/2 = $\frac{86}{3.1\ L}$; L = 18.85

H= 1.3'
Find depth of flow at emergency spillway
Crest for 24' wide spillway. Flow through principal spillway: 86 cfs.
Flow in emergency spillway

= 151-86=65 cfs. H 2/2 = $\frac{65}{3xL=3x24}$ = $\frac{65}{}$ = 0.903

H = 093'

Base of Riser	
Bottom of Pond	736
Top of Permanent Sediment Storage	737.2
Top of Permanent Water Quality Storage	741.2
Top of Temporary Water Quality Storage	741.3
Crest of emergency spillway	742.6
100 – year peak flow elevation	743.5
Top of Bank	744.5

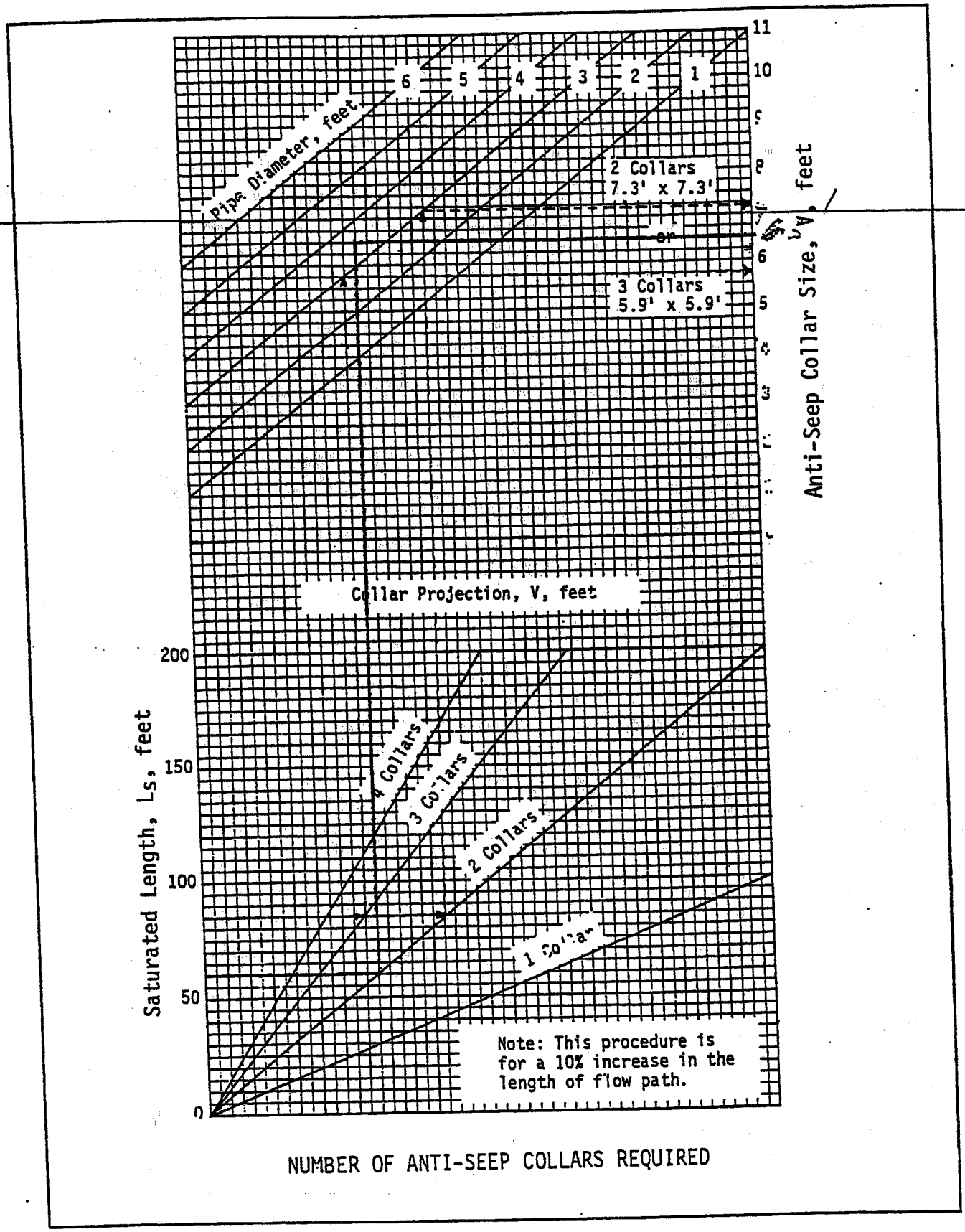
Qpz = 43 cfs.
Qpz = 86 cfs.
Qpz= 107 cfs.
Qpz = 151 cfs.

SB-1 Inlet
Worksheet for Circular Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrrhp2.fm2
Worksheet	SB-3 Inlet
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.015000	ft/ft
Diameter	36.00	in
Discharge	25.00	cfs

Results		
Depth	13.7	in
Flow Area	2.46	ft^2
Wetted Perimeter	3.98	ft
Top Width	2.91	ft
Critical Depth	1.61	ft
Percent Full	37.96	
Critical Slope	0.004409	ft/ft
Velocity	10.16	ft/s
Velocity Head	1.60	ft
Specific Energy	2.74	ft
Froude Number	1.95	
Maximum Discharge	87.87	cfs
Full Flow Capacity	81.68	cfs
Full Flow Slope	0.001405	ft/ft
Flow is supercritical.		



Source: USDA-SCS

Plate 3.14-12

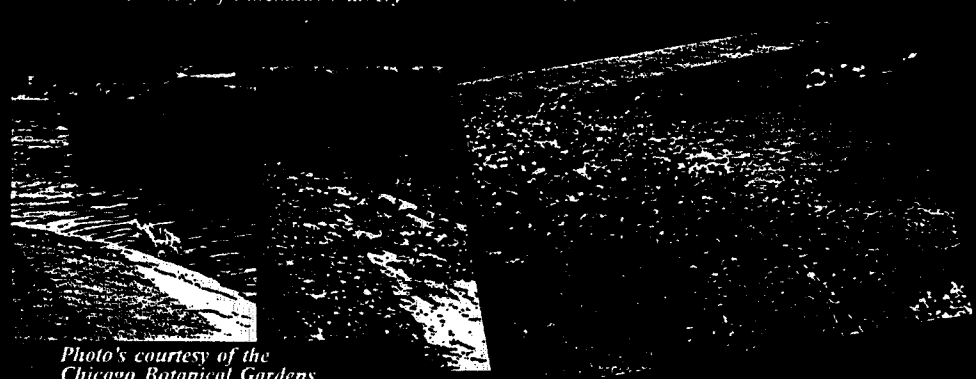
Erosion Control... Nature's Way.

EnTerra® America

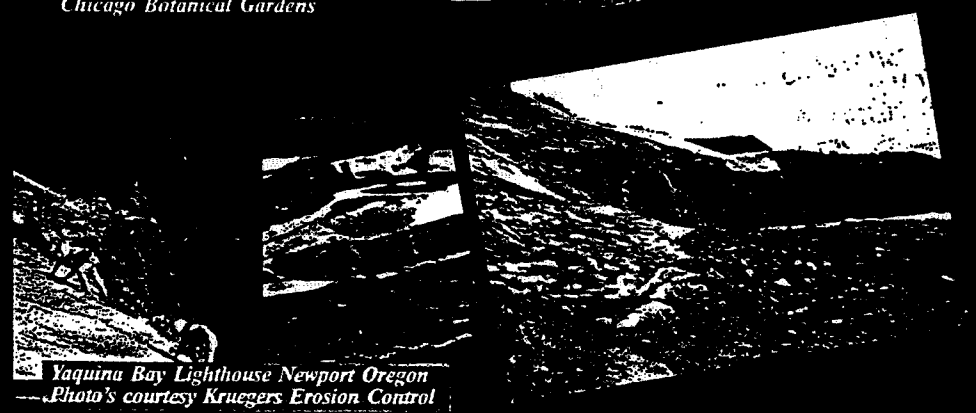
Product Guide

- *Agricultural Drainage*
- *Airfields*
- *Bridge Abutments*
- *Channel Liners*
- *Channel Shoulders*
- *Culvert Outfalls*
- *Cuttings and Hillsides*
- *Dams*
- *Detention Ponds*
- *Drought Area Revegetation*
- *Earth Dam Vegetation*
- *Golf Course Wetlands Construction*
- *Grassed Waterways*
- *High Elevation Vegetation and Reclamation*
- *Hiking Trail Development*
- *Interim Erosion Control During Construction*
- *Landfill Reclamation*
- *Landscaping*
- *Logging Reclamation*
- *Mine Reclamation*
- *Natural Lakes*
- *Tidal Marshes*
- *Rail Embankments*
- *Reservoirs*
- *Revegetate Cut and Fill Slopes*
- *Revitalize Polluted River Embankments*
- *River Floodplains*
- *Road Embankments*
- *Ski Slopes*
- *Ski Lift Trades*
- *Slide Reclamation*
- *Slopes Landscaping*
- *Shoreliner*
- *Stream Bank Reclamation*
- *Wildflower Establishment*

Photo's courtesy of Pinelands Nursery



Photo's courtesy of the Chicago Botanical Gardens



Yaquina Bay Lighthouse Newport Oregon
Photo's courtesy Kruegers Erosion Control

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job Mer d HP

Job No. 600.03 Sheet No. ____ of ____

Calculated by CK Date 7/11/07

Checked by ____ Date ____

Subject Misc Scale ____

Slope drain sizing, cont'd

then

for 6" pipe

$Q_{full} = (1.49/0.22)(0.1763)(0.125)^{2/3}(0.33)^{1/2} = 1.91$ c/o

for 12" pipe

$Q_{full} = (1.49/0.22)(0.7854)(0.25)^{2/3}(0.33)^{1/2} = 12.13$ c/o

for 18" pipe

$Q_{full} = (1.49/0.22)(1.7671)(0.375)^{2/3}(0.33)^{1/2} = 35.73$ c/o

~ orifice inflow limits capacity of pipe

Slope Drain Schedule

Area	Q_{25} (c/o)	Slope Drains
2	10.6	2 x 18"
3	12.5	2 x 18"
4	10.3	2 x 18"
5	10.8	2 x 18"
6	12.4	2 x 18"

See pp. ( ) ( ) & Q-5 (Fill in when appendix done)

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job Ilex & High Mrx

Job No. 600.03 Sheet No. ____ of ____

Calculated by CK Date 7/1/02

Checked by ____ Date ____

Subject E+SC Scale ____

Slope Drain Sizing

Check orifice inflow rate

→ use $Q = ca\sqrt{2gh}$ → from Standard Handbook for Engineers, p. 21-28

Check following pipe sizes

Pipe diameter	area (ft^2)	c
6"	0.1963	0.6
12"	0.7854	0.59
18"	1.7671	0.58

c = coefficient of discharge, taken from or based on Table 21-3, Standard Handbook for Civil Engineers, assuming 1' head above of pipe

Then for

6" pipe $Q = (0.6)(0.1963)(2*32.2*1)^{1/2}$ = 0.74 c/s

12" pipe $Q = (0.59)(0.7854)(2*32.2*1)^{1/2}$ = 3.72 c/s

18" pipe $Q = (0.58)(1.7671)(2*32.2*1)^{1/2}$ = 8.22 c/s

Check inflow vs capacity of pipe using

$$Q_{full} = (1.49/n)(a)(r_h)^{2/3}s^{1/2}$$

from Civil Engineering Reference Manual p. 15-5

Use $s = 0.33$ ~ 3H:1V assumed

$n = 0.22$ ~ from App 5A, Civil Engineering Reference Manual, corrugated metal pipe

$r_h = 1/4\,d$

JOYCE ENGINEERING, INC

Waste Industry Experts

Job MRL @ High Point

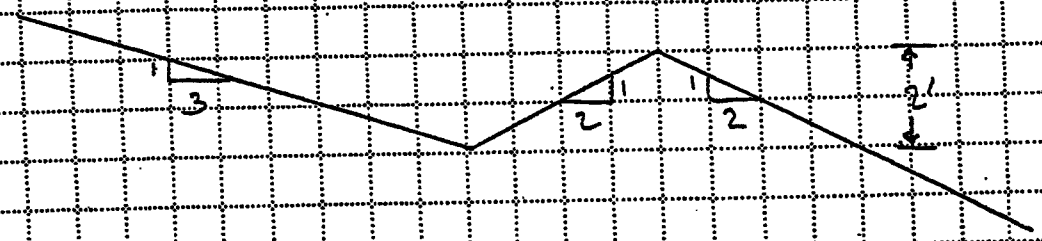
Job No. 600.03 Sheet No. ____ of ____

Calculated by CW Date 7/1/02

Checked by ____ Date ____

Subject Erosion Scale ____

Check diversion dike



Check capacity vs largest area draining to diversion berm

Use area = (300x100) = 18000 ft² or = 0.41 acres

C = 0.6

i = 7.2 (max 25 yr storm intensity)

q = CiA = (0.6)(0.41)(7.2) = 1.77 c/s

Check capacity (25 yr storm, high retardance)

max depth flow = 0.27 ft ~ capacity = ok

check velocity (25 yr storm, earth lining)

velocity = 3.44 ft/sec ~ use temporary lining

Check shear stress in temporary liner

T = yds

γ = unit weight water = 62.4

d = depth flow = 0.53

S = channel gradient = 0.02

T = (62.4)(0.53)(0.02) = 0.66

~ allowable shear for straw with netting = 1.45

Diversion Berm, 25 Yr Storm, Low Retard
Worksheet for Triangular Channel

Project Description	
Project File	c:\haestad\fmw\mrr high.fm2
Worksheet	Diversion Berm
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.087	
Channel Slope	0.020000	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	2.000000	H : V
Discharge	1.77	cfs

Results		
Depth	0.77	ft
Flow Area	1.46	ft^2
Wetted Perimeter	4.13	ft
Top Width	3.83	ft
Critical Depth	0.50	ft
Critical Slope	0.193960	ft/ft
Velocity	1.21	ft/s
Velocity Head	0.02	ft
Specific Energy	0.79	ft
Froude Number	0.34	
Flow is subcritical.		

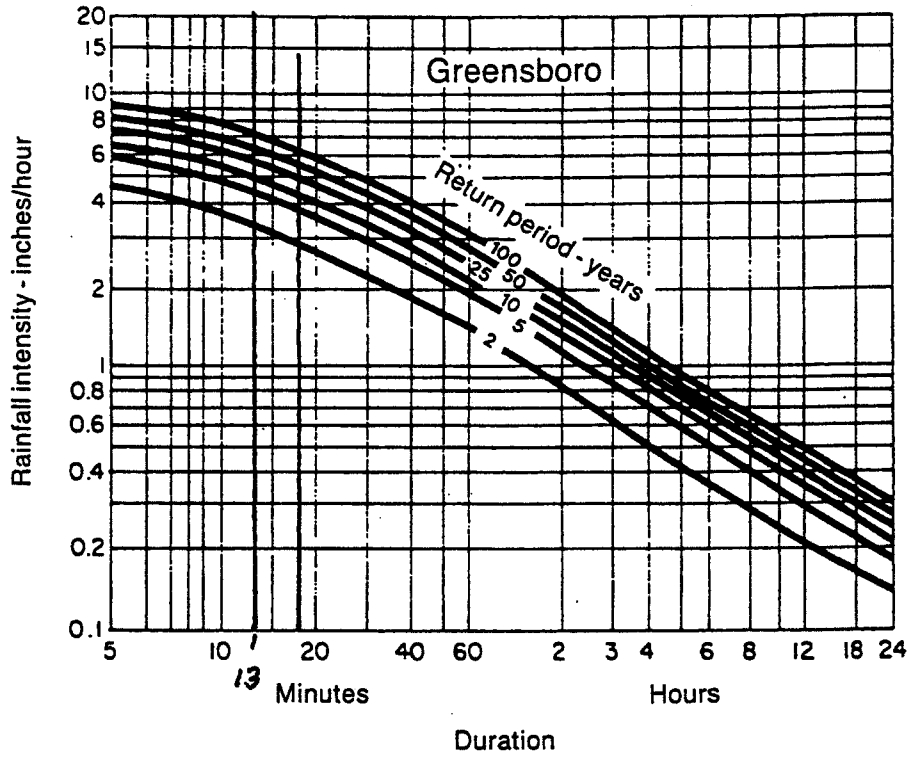


Figure 8.03d Rainfall intensity duration curves—Greensboro.

$I_2 = 3.38$

$I_5 = 4.50$

$I_{10} = 5.00$

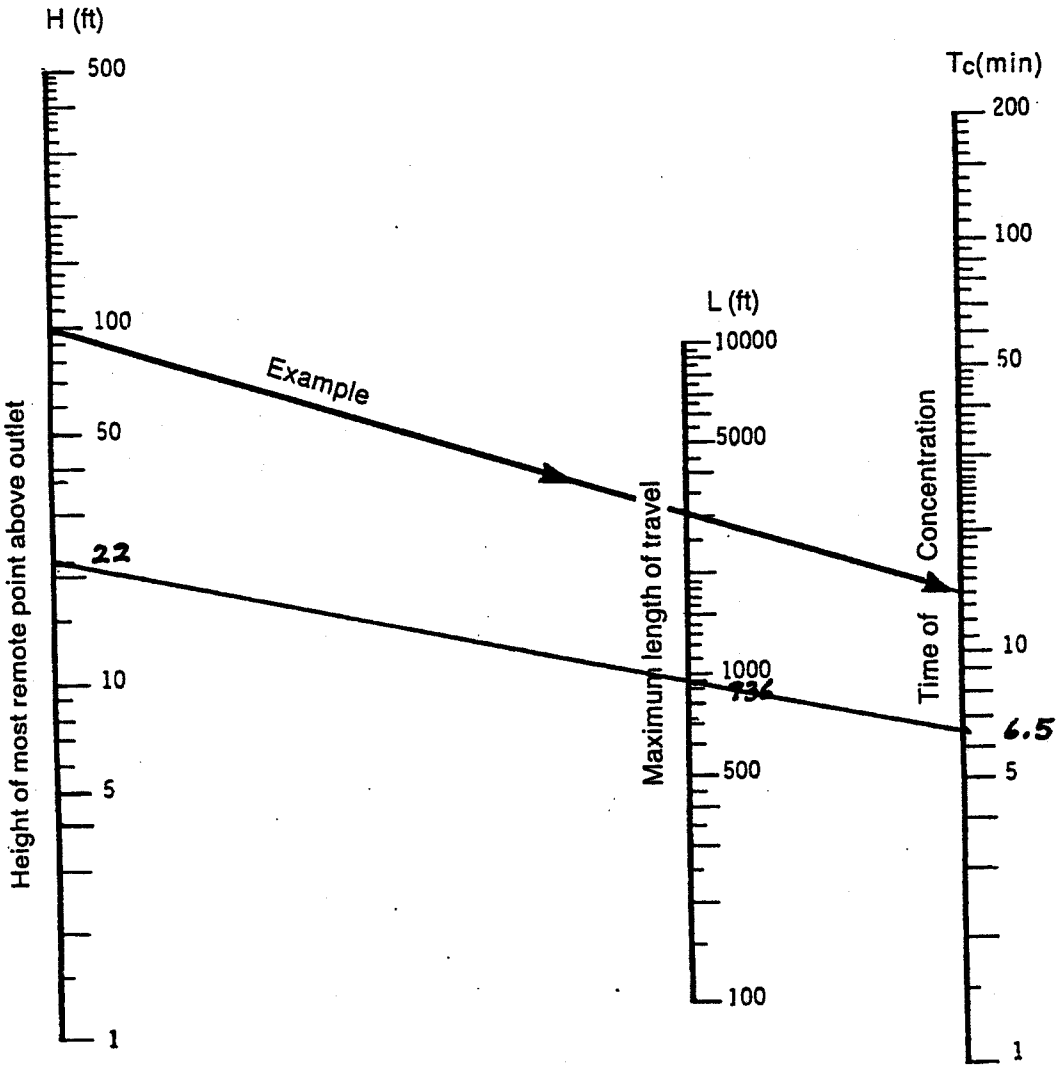
$I_{25} = 5.70$

$I_{50} = 6.20$

$I_{100} = 7.10$

TRAP

SEDIMENT - ~~BASIN~~ 2



Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2. $T_c = 2(6.5\ min.) = 13\ minutes$

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

JOYCE ENGINEERING, INC.

Waste Industry Experts

Pre 4.90 acre
Post - 7.49

Job
Job No. Sheet No. of
Calculated by JAD Date 6/24/02
Checked by Date
Subject SB-1 Scale

Total drainage area = 7.57 ac.

impervious area = 0.64 * 4.2 = 4.84 ac.

% Contribution = 4.84 / 7.57 = 64 %

- End Permanent Pool Surface Area to Drainage Area Ratio

Ref. p. 8, High Point Stormwater BMP Design Manual

For 3' depth, 64% to limit upon use,

Ratio = (2.75 - 2.39)(0.4) + 2.39 = 2.53 ; .0253 X 7.57 ac
= .19 ac = 8276 sf.

Increase by 20% to meet Condition B of pre and post = 9931 sf
(.23 ac

Calc. composite curve no.

Land Use	Area	CN	
Grassed	2.73 ac	74	(Exist)
Paved	4.84 ac	98	

Composite CN: $\frac{74(2.73) + 98(4.84)}{7.57} = 89$

10,540 sf. =
provided: 9
= 7.24 a

(.38 ac

Temporary water storage to be provided by the use of sediment basin 1 and basin 2 (Exist.)

Runoff curve #: $\frac{(A - I_a)}{(A - I_a) + S}^2$; $S = \frac{1000}{CN} - 10 = 1.24$

$I_a = 0.25 = 0.2 * 1.24 = 0.25$

$R = \frac{(A - 0.25)}{(A - 0.25) + 1.24}^2 = 0.25$ in/hr

FW, TR55
25 SCS
June 1955

FORCE ENGINEERING, INC.

Waste Industry Experts

Job

Job No. _____ Sheet No. _____ of _____

Calculated by _____ Date _____

Checked by _____ Date _____

Subject SB-1 Scale _____

1) Calculate storage

Provide 0.5 ac-in storage per Detention

area drawing in the town.

Vadj = 0.5 in × 7.57 ac = 3.785 ac-in

$\frac{3.785 \text{ ac-in}}{0.24 \text{ ac}} = 15.77' = 1.3'$

Permanent water quality storage in the 3' depth

0.24 ac town

2) Temporary water quality detention required

$= \frac{0.28 \text{ inches runoff}}{12 \text{ in/ft}} \times 7.57 \text{ ac}$

$= 0.18 \text{ ac-ft}$

$\text{depth} = \frac{0.18 \text{ ac-ft}}{0.38 \text{ ac}} = 0.47' \text{ say } 0.5'$

pond per

JOYCE ENGINEERING, INC.

Waste Industry Experts

Job _____

Job No. _____ Sheet No. ____ of ____

Calculated by _____ Date _____

Checked by _____ Date _____

Subject SB-1 Scale _____

$Q_{P10} = C \times A$

$T_c = 7.5$ min.

C_{10}: 0 in/hr, $k_{2.5}$: 7 in/hr $k_{100} = 8.5$ in/hr.

$C = \frac{(2.72)(0.20) + (4.84)(0.70)}{7.5 - 7} = 1.65$

Rational method Equation (Engineering Hydrology Manual, Orange) = Table C 7.2.0

$A = 7.57$ ac.

$Q_{P10} = (1.65)(6)(7.57)$ $Q_{P25} = (1.65)(7)(7.57)$ $Q_{P100} = (1.65)(8.5)(7.57)$

$= 29.5$ cfs. $= 34.4$ cfs. $= 41.8$ cfs.

Slope from (for Q_{P10}; $H = 784 - (774 + 2.5) = 7.5'$

→ Use 36" Barrel, $A = \pi r^2 = 1018$ in^2; capacity = 30.5 cfs

Cross section area of pipe (Use 1' less than 3' cross section area of barrel (Use 48" in.

Cross sectional area = 1809 in.^{2} $\frac{1809}{1018} = 1.78 > 1.50$

Hat $Q_{P25} = 0.8$ ft Hat $Q_{P100} = 1.05'$

Check freeboard at Q_{P100}

Freeboard = $794.0 - (790.8 + 1.05) = 2.15' > 1.0'$

O.K.

ENGINEERING, INC.

Waste Industry Experts

Job No. _____ Sheet No. ____ of ____

Calculated by _____ Date _____

Checked by _____ Date _____

Subject SB-1 Scale _____

Pond 1

Select orifice to provide 5-day drawdown period.

Use 3/4" hole (Cross-sectional area of hole = 0.00306 ft.²)

$A_{o\,required} = \frac{A_s\sqrt{2h}}{T_d \cdot 20,428}$; T = 5 days = 120 hours

A_s = surface area at normal pool = 0.38 ac = 16,553 ft.²

h = max. head above hole = 0.5'

$A_o = \frac{16,553\sqrt{2\times0.5}}{120\times0.6\times20,428}$

$= 0.0159$ ft.²

$\frac{0.0159\ ft^2}{0.00306\ ft^2/hole} = 5$ holes

Portable Toilet Block

Find footprint wt. of soils displaced by 48" pipe.

Wt of soils displaced = $\pi(2)^2(78.8-776.0)(62.4)$

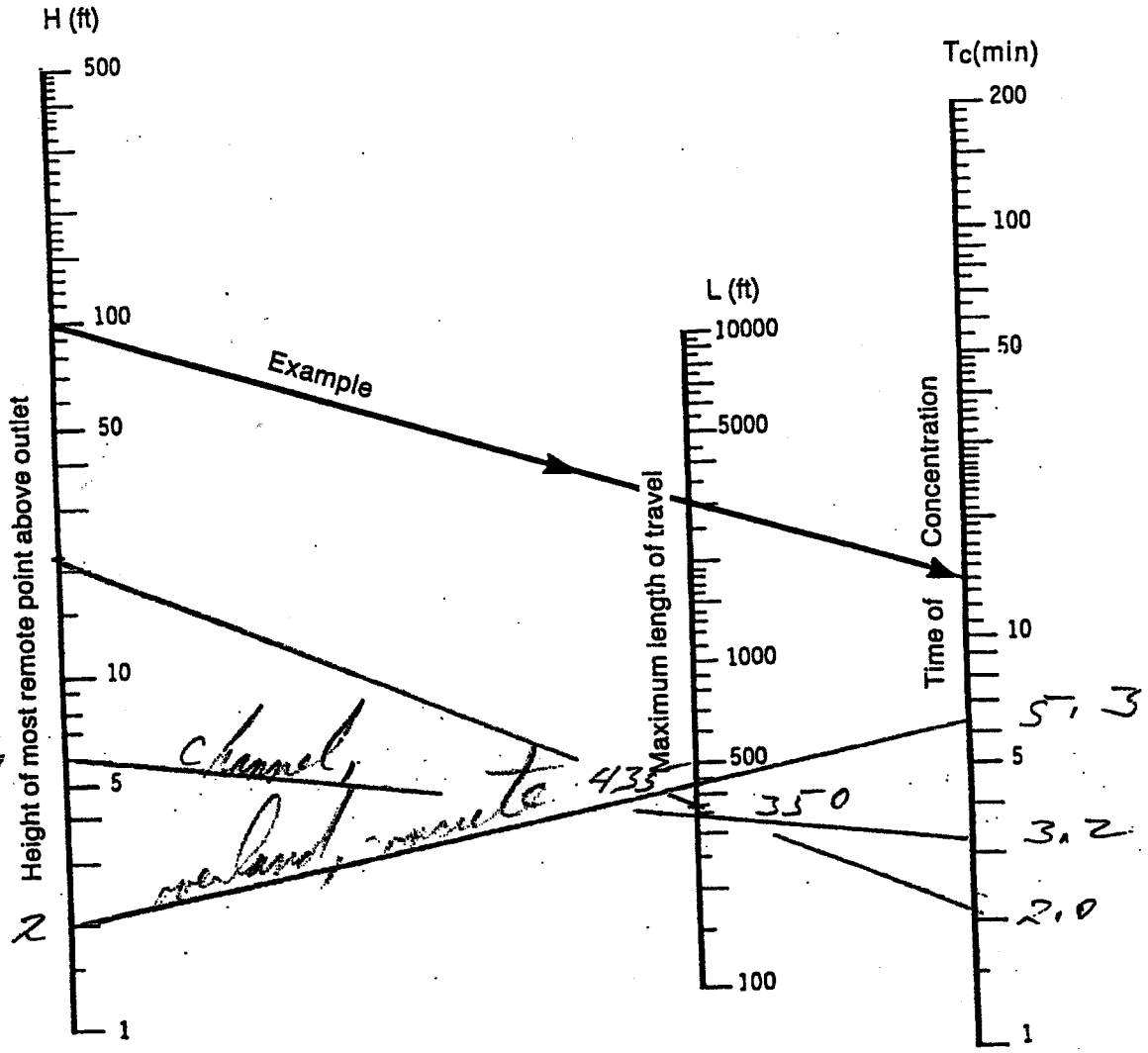
$= 5332$ #

1.1 X 5332 = 5865 #

Volume of block required = $\frac{5865}{(155-68.4)} = 67$ ft.³

Use block 18" thick X 7' square

SB-1



$H_2 = 900 - 778 = 22$

$H_1 = 6$

Channel, overland, commercial t_c 433 350

Note:
Use nomograph Tc for natural basins with well-defined channels, for overland flow on bare earth, and for mowed-grass roadside channels.

For overland flow, grassed surfaces, multiply Tc by 2.

For overland flow, concrete or asphalt surfaces, multiply Tc by 0.4.

For concrete channels, multiply Tc by 0.2.

Figure 8.03a Time of concentration of small drainage basins.

A Overland flow: $t_c = 0.4 \times 5.3 = 2.1$ min.

B Channel = 3.2 min.

C Channel = 2.0 $\therefore T_c = 2.1 + 3.2 + 2.0$

SB-1

$i_{100} = 8.5$ in/hr.
$i_{25} = 7$ in/hr.
$i_{10} = 6$ in/hr.
$i_2 = 4$ in/hr.

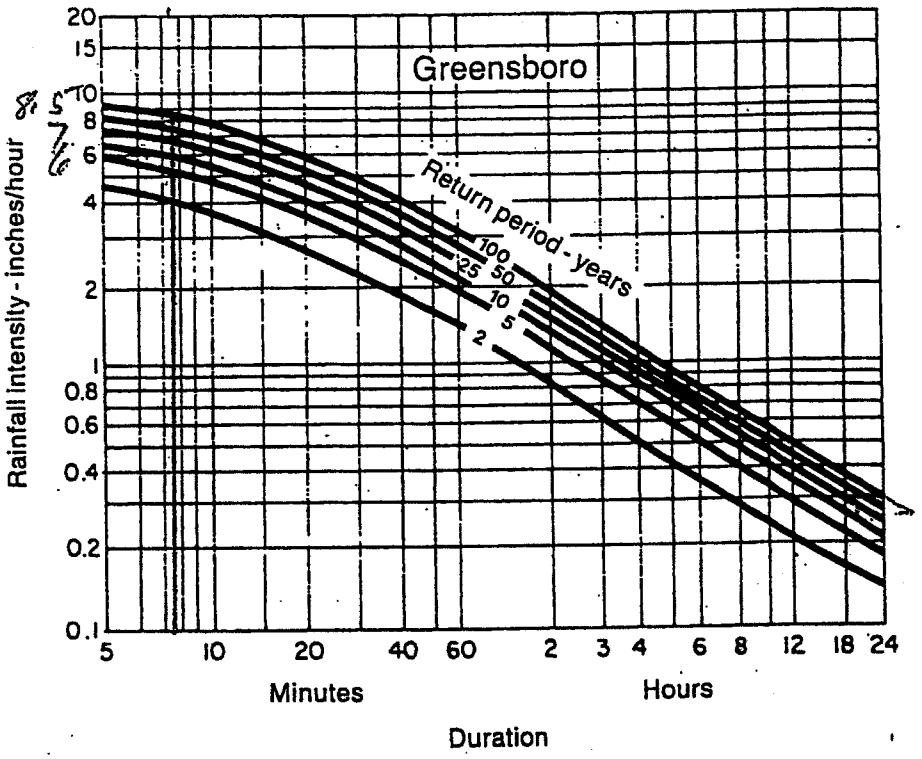


Figure 8.03d Rainfall intensity duration curves—Greensboro.

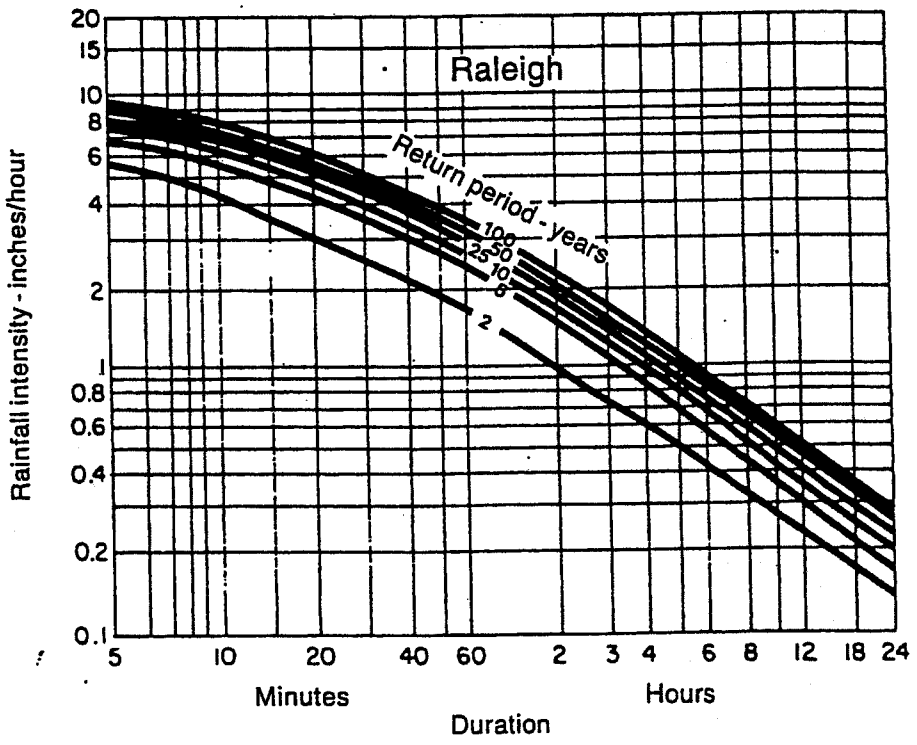


Figure 8.03e Rainfall intensity duration curves—Raleigh.

SB-1

8

H = 782.8 - (772.0 + Conc Slope Adj)

For 36" Cond, H = 7.81'

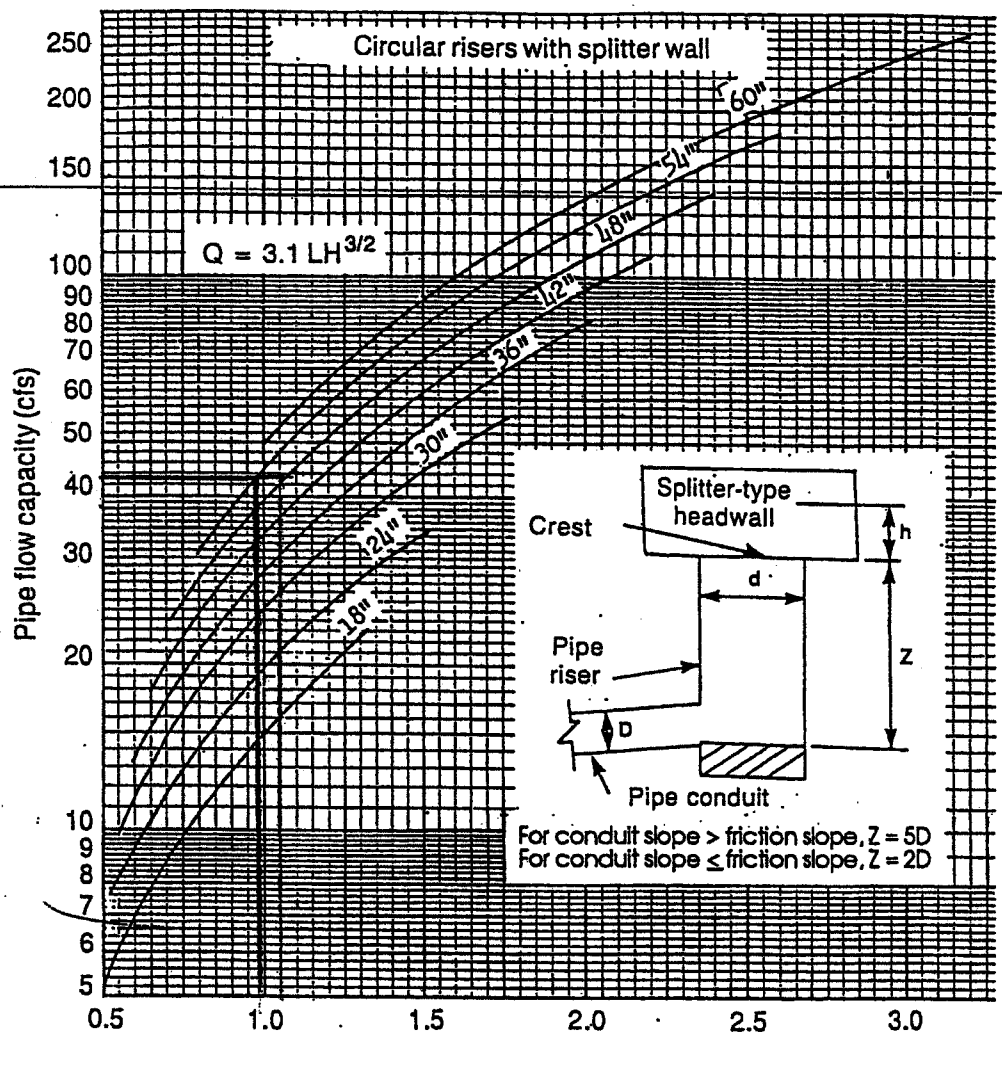
Table 8.07a

Pipe Flow Chart for Design of Corrugated Metal Outlet Conduit
(Q in cubic ft/sec)

For Corrugated Metal Pipe Inlet $K_e + K_h = 1.0$ and 70 feet of Corrugated Metal Pipe Conduit n = 0.025. Note correction factors for other pipe lengths.

Dia. / H	12"	15"	18"	21"	24"	30"	36"	42"
2	2.84	4.92	7.73	11.30	15.60	26.60	40.77	58.12
3	3.48	6.03	9.47	13.84	19.10	32.58	49.93	71.19
4	4.02	6.96	10.94	15.98	22.06	37.62	57.66	82.20
5	4.49	7.78	12.23	17.87	24.66	42.06	64.46	91.90
6	4.92	8.52	13.40	19.57	27.01	46.07	70.60	100.65
7	5.32	9.21	14.47	21.14	29.19	49.77	76.28	108.75
7.8	5.68	9.84	15.47	22.60	31.19	53.19	81.53	116.23
9	6.03	10.44	16.41	23.97	33.09	56.43	86.49	123.30
10	6.36	11.00	17.30	25.26	34.88	59.48	91.16	129.96
11	6.67	11.54	18.14	26.50	36.59	62.39	95.63	136.33
12	6.96	12.05	18.95	27.68	38.21	65.16	99.87	142.37
13	7.25	12.55	19.72	28.81	39.77	67.83	103.96	148.21
14	7.52	13.02	20.47	29.90	41.27	70.39	107.88	153.80
15	7.78	13.48	21.19	30.95	42.72	72.85	111.66	159.18
16	8.04	13.92	21.88	31.96	44.12	75.24	115.32	164.40
17	8.29	14.35	22.55	32.94	45.48	77.55	118.87	169.46
18	8.53	14.77	23.21	33.90	46.80	79.81	122.33	174.39
19	8.76	15.17	23.84	34.83	48.08	81.99	125.67	179.15
20	8.99	15.56	24.46	35.73	49.33	84.12	128.93	183.80
21	9.21	15.95	25.07	36.62	50.55	86.21	132.13	188.36
22	9.43	16.32	25.65	37.47	51.73	88.22	135.21	192.76
23	9.64	16.69	26.23	38.32	52.90	90.21	138.27	197.12
24	9.85	17.05	26.80	39.14	54.04	92.15	141.24	201.35
25	10.05	17.40	27.35	39.95	55.15	94.05	144.15	205.50

L	Correction Factors For Other Pipe Lengths							
40	1.23	1.22	1.20	1.19	1.16	1.14	1.13	1.11
50	1.14	1.13	1.12	1.11	1.10	1.09	1.08	1.07
60	1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.03
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	0.95	0.95	0.95	0.96	0.96	0.96	0.97	0.97
90	0.90	0.91	0.91	0.92	0.92	0.93	0.94	0.94
100	0.86	0.87	0.88	0.89	0.89	0.90	0.91	0.92



H = 1.05' for 48" Pipe

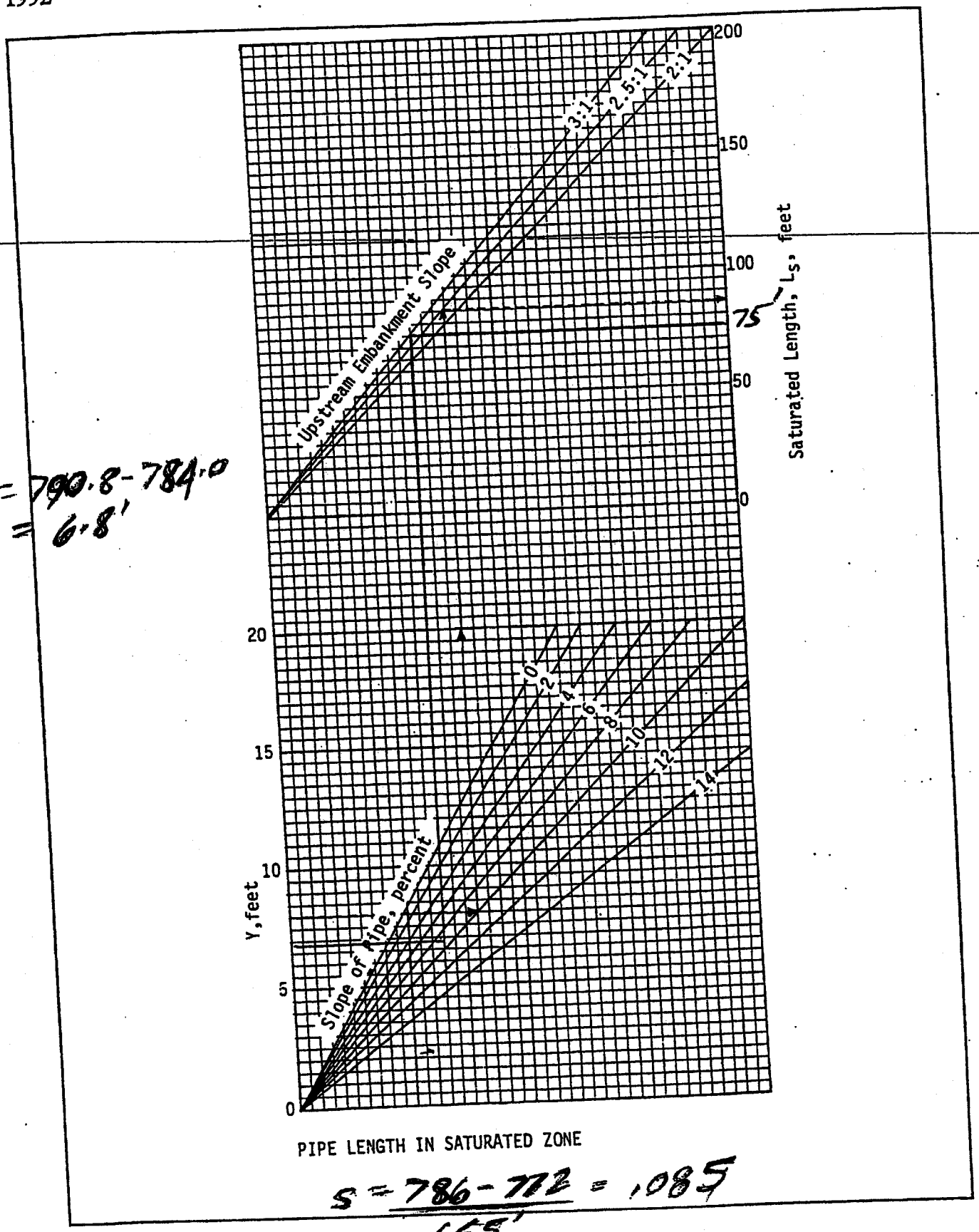
Inlet Proportions	
Pipe Conduit (D) - in	Pipe Riser (d) - in
8-12	18
15	21
18	24
21	30
24	30
30	36
36	48
42	54
48	60

Pipe drop inlet spillway design:

For a given Q and H, refer to Table 8.07a or 8.07b for conduit size. Then determine the riser diameter (d) from the Inlet Proportions Table on this figure. Next, refer to the above curves, using the conduit capacity and riser diameter, and find the head (h) required above the crest of the riser. The height of the riser should not be less than 5D - h, except as noted in the above sketch.

Example - Given: CMP; Q = 20 cfs; H = 14 ft, h max. 1.0 ft; L = 70 ft. From Table 8.07a find conduit size (D) = 18 inches. From Inlet Proportions Table, riser size = 24 inches. Head (h) required for Q = 20 and d = 24 is 1.0 ft.

Figure 8.07b Design chart for riser outlet.



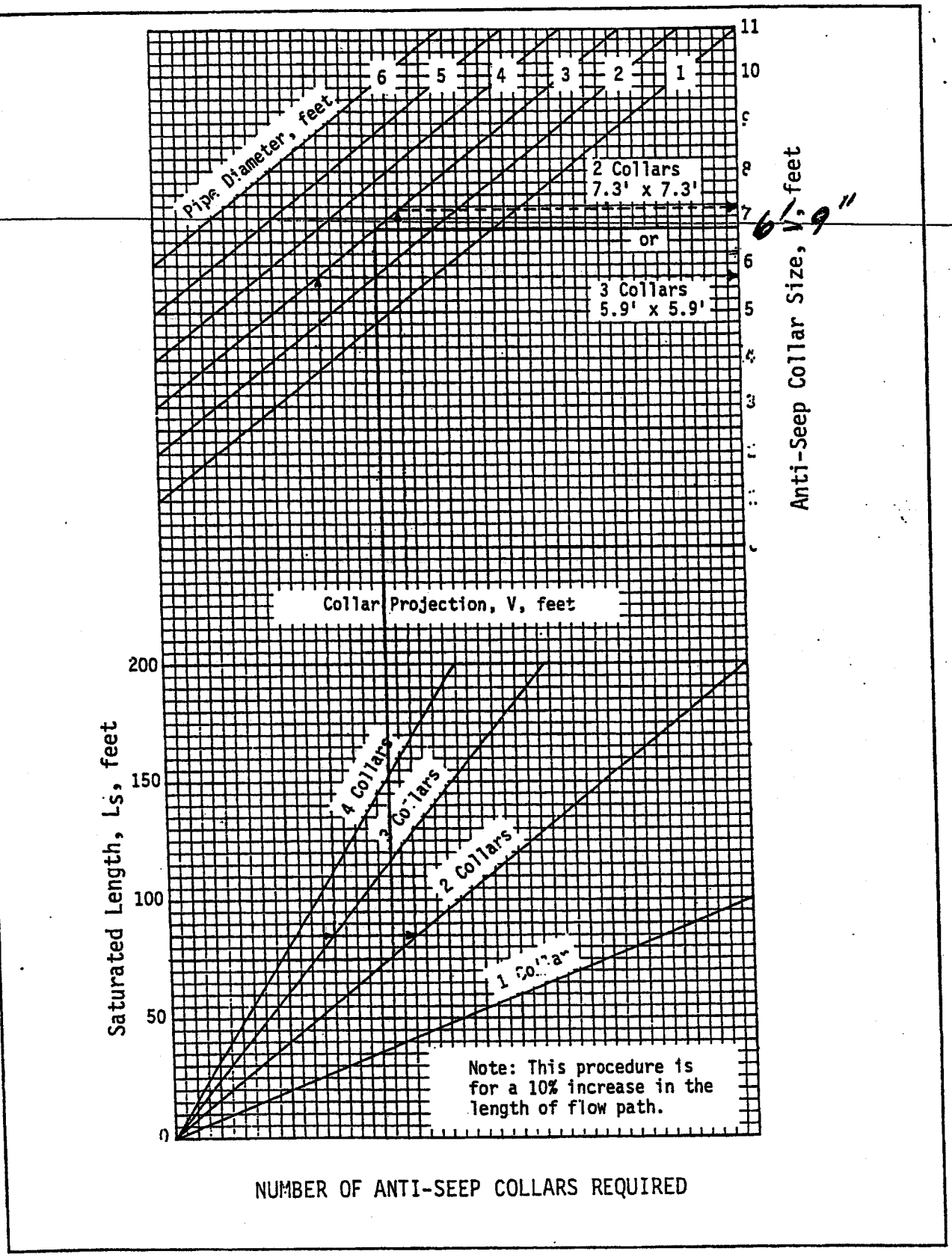
$Y = 790.8 - 784.0 = 6.8'$

$S = \frac{786 - 772}{165'} = .085$

Source: USDA-SCS

Plate 3.14-11

SB-1



6' 9"

Source: USDA-SCS

Plate 3.14-12

30" RCP CULVERT: SCC-8 TO SB-1
Worksheet for Circular Channel

Project Description	
Project File	f:\apps\haestad\fmstr-w\mrr-hp-s.fm2
Worksheet	MRR-HP - 24" PIPE TO SB#1 - SDY
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Diameter	30.00	in

Results		
Depth	2.50	ft
Discharge	58.00	cfs
Flow Area	4.91	ft²
Wetted Perimeter	7.85	ft
Top Width	0.00	ft
Critical Depth	2.38	ft
Percent Full	100.00	
Critical Slope	0.017335	ft/ft
Velocity	11.82	ft/s
Velocity Head	2.17	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	62.40	cfs
Full Flow Capacity	58.00	cfs
Full Flow Slope	0.020000	ft/ft

APPENDIX 5

Post Closure Inspection Forms

1. Post Closure Inspection Record

2. Groundwater Monitoring Well Maintenance Record

1. Post Closure Inspection Record

POST-CLOSURE INSPECTION RECORD

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

---

1. Access and Security Control

- ☐ Is a notice prohibiting the further disposal of waste materials clearly visible at the entrance to the facility?
- ☐ Is the site adequately secured by means of gates, chains, berms, fences or other security measures to prevent unauthorized entry?
- ☐ Are the access roads to and within the site maintained to provide access to the closed disposal area and to all monitoring points?

2. Erosion and Sediment Control

- ☐ Is the vegetation adequate to stabilize the site and prevent erosion?
- ☐ Are the erosion control measures adequate to prevent silt from leaving the site and to prevent excessive on-site erosion?
- ☐ Do the sediment basins require cleaning out, as indicted by the level of sediment buildup?

3. Drainage Control Requirements

- ☐ Are all areas adequately sloped to promote surface water runoff in a controlled manner?
- ☐ Are there areas of observed settlement, subsidence, and/or displacement of the closure cap?
- ☐ Are all drainage channels free of accumulated sediment?

4. Uncontrolled Escape of Leachate or Landfill Gas

- ☐ Are there any leachate seeps observed?
- ☐ Are there any signs of uncontrolled releases of landfill gas?

5. Environmental Monitoring Systems

- ☐ Are all monitoring wells (gas and groundwater) properly maintained? (Note: Complete the Groundwater Monitoring Well Maintenance Record during semi-annual sampling events.)

6. Miscellaneous

- ☐ Are all site benchmarks marked and evident?
- ☐ Do vector control measures appear adequate?

2. Groundwater Monitoring Well Maintenance Record

GROUNDWATER MONITORING WELL MAINTENANCE RECORD

FACILITY: _____ PERMIT NO. _____

LOCATION: _____ DATE: _____

INSPECTOR: _____ COMPANY: _____

---

1. Is surface water diverted away from the well head? _____
2. Is the concrete pad still intact and free of cracks? _____
3. Has surface water runoff undercut the concrete pad? _____
4. Is the outer casing still secure and locked? _____
5. Is the well identification tag present and is it legible? _____

   5a. Does the well identification tag provide the following information:

   - The well identification number? _____
   - Drilling contractor name and registration number? _____
   - Total depth of well? _____
   - Depth to screen? _____
   - A warning that the well is not for water supply and that the ground water may contain hazardous materials? _____

6. Is the grout between the inner and outer well casings all the way to the ground surface?
7. Is the inner casing firmly grouted in place? _____
8. Are the inner and outer casings upright and unobstructed? _____
9. Is water collecting in the outer casing? Does a weep hole need to be bored in the outer casing to provide drainage? _____
10. Is the monitoring well accessible by a four-wheel drive vehicle? _____
11. Have brush and weeds been trimmed so that the well is easy to locate and access?
12. Does the inner well casing have a vented cap? _____
13. Is the monitoring well visible and adequately protected from moving equipment?